EFFECT OF PENSION MANDATORY CONTRIBUTION ON STOCK MARKET RETURNS, ANALYST FORECASTS AND INSTITUTIONAL HOLDINGS

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

Mancang Dong

May 2011

© 2011 Mancang Dong

EFFECT OF PENSION MANDATORY CONTRIBUTION ON STOCK MARKET RETURNS, ANALYST FORECASTS AND INSTITUTIONAL HOLDINGS

Mancang Dong, Ph. D.

Cornell University 2011

The impact of pension information on market valuation is an important issue that has not to date been explored in depth. I investigate how the market, analysts and institutional investors respond to mandatory pension contributions to gain insight on the utilization of pension information. Using plan-level pension Form 5500 Schedule B data, I find that firms that make mandatory contributions frequently have lower market returns than those that make mandated contributions for shorter periods. I classify mandatory contribution (MC) firms into three groups: Lenient (LEN), Perpetual (PER) and Revert (REV) firms based on factor and cluster analyses that capture different MC characteristics, and show that market responses vary systematically across the identified groups of MC firms. I also find evidence that analysts take MC into consideration but are unable to fully understand the implications of different MC patterns, resulting in larger forecast errors for some MC group firms than for others. Finally, I demonstrate that institutional investors take MC into consideration two years after the firm's first MC occurrence. Institutional investors react to the MC firm groups differently depending on the investing class and style. These findings suggest that the responses of the market, analysts and institutional investors depend on the nature of the MC patterns exhibited by different firms.

BIOGRAPHICAL SKETCH

Mancang Dong was born and grew up in Shanxi, China. He earned a B.S. in 1977 and an M.S. in 1981 from the Shanxi Agricultural University. He then joined the Chinese Academy of Agricultural Science in 1982 and worked there for two years. In June 1984, he came to the U.S. to pursue his doctoral studies in Animal Breeding with a minor in Biometrics at Cornell University.

After completing his doctoral studies at Cornell in 1987, Mancang spent two years as a Postdoctoral Associate at Michigan State University and then returned to Cornell University to work as a Research Associate in 1990. While doing research on several projects, he became proficient in data manipulation, programming and computing skills as he analyzed large data sets from the U.S. dairy and cattle industry.

Mancang joined the Johnson Graduate School of Management in 1997 as a faculty research specialist and was later promoted to director of Research Computing, responsible for research computing and data management. To better understand the financial data and provide in-depth support to faculty and Ph.D. students for their research, Mancang started taking Management courses in spring 1999. As his financial knowledge grew, not only did his work become more efficient and effective, but he also became more and more interested in financial research. This eventually led him to apply to the doctoral program in Management and he was admitted in spring 2006.

To all who have made this dissertation possible

ACKNOWLEDGMENTS

I am most thankful to Julia D'Souza, the chair of my doctoral committee, for her invaluable guidance, generous support and constant encouragement in the course of my studies. She has put a great deal of time and effort in working with me to refine this research project and improve my paper. She also inspired my interest in studying pension plans. I would like to thank my committee members, Warren Bailey and Yongmiao Hong for their sound advice, valuable inputs and constructive criticisms. I am very grateful to Charles Lee, also a good friend, for encouraging me to apply for the job at the Johnson School and supporting me in applying to the Ph.D. program. I am especially thankful to Maureen O'Hara for understanding my strengths and weaknesses, having confidence in me and supporting my doctoral study program. I am indebted to my formal supervisors, formal Associate Deans John Elliot, Joseph Thomas, Mark Nelson and my current supervisor, Associate Dean Sachin Gupta for their continuous support and warm encouragement. Thanks are also due to the faculty and Ph.D. students in the accounting group for good teaching, generous help, useful ideas and insightful suggestions. I have benefited tremendously from the Ph.D. seminars and accounting workshops.

I appreciate all faculty, staff, and Ph.D. students at the Johnson School for providing me with warm support, encouragement and friendship. It is a rewarding experience to work and study at this great school.

Finally, I would like to thank my family for their support, forbearance and love during my studies. My lovely wife, Jenny, has always been a faithful supporter and

companion on this journey. Without her loving sacrifice, it would have been impossible for me to accomplish this goal.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

U.S. companies that sponsor defined benefit (DB) pension plans are required by law to make a mandatory contribution (MC) to the plan if the plan's underfunded level is below certain limits. Past research (e.g., Picconi (2004); Coronado et al. (2008)) suggests that the implications of pension accounting information in footnotes accompanying financial statements are not fully understood by market participants. MCs have a direct cash flow impact on companies (Rauh, 2006). It is therefore particularly important to understand the performance and valuation implications of MCs, and how different MC characteristics (MC period length, continuous vs. interrupted MC strings) are associated with performance and valuation. These are the hitherto unanswered questions that this study addresses.

Using plan-level pension Form 5500 Schedule B data from the Department of Labor (1991-2005), I identify 2,667 firms that make mandatory pension contributions over a period ranging from one year to 15 years. Combining the pension data of these firms with financial information from Compustat, stock information from CRSP, analyst information from I/B/E/S and institutional holdings information from CDA/Spectrum 13f data, I investigate stock market reactions, analyst forecasts and revisions and institutional holdings for these firms over the sample period. Instead of using firm-year groupings, I group my firms by MC attributes (e.g., length of MC period, distance between non-consecutive MC strings) to gain deeper insight into the impact of MC for the firm.

Overall, results show that firms that are not required to make any mandatory pension contribution during the sample period are associated with higher returns (raw, size-adjusted or risk-adjusted) than firms that make mandatory contributions over a period longer than one year. These findings are consistent with prolonged MC periods being an indicator of decreased financial resources and poorer future prospects for the

firm.

Analysts seem to incorporate some of the MC information into earnings forecast but can't differentiate between different MC characteristics, resulting in larger forecast errors for firms with more protracted MC strings. Forecast accuracy decreases and forecast revision increases as the length and complexity of the MC string increases. Institutional investors seem to recognize the implications of MC two years after the first MC occurrence. Depending on the investment class and style, institutional investors' responses to MC vary across various MC firm groups. The quasi-indexers, large value and large growth investors can differentiate between firms with more serious funding shortfalls and other MC firm groups, and hold substantial fewer shares in the former. Transient investors also hold reduced shares in firms with more serious funding shortfalls. However, dedicated and small investors don't treat different MC firm groups differently.

This paper makes several contributions to existing literature. It is the first study to analyze the link between MC patterns and firm performance and valuation. It makes a significant contribution to the pension literature and augments the literature on market efficiency and efficient valuation.

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

2.1. Mandatory Pension Contributions

The U.S. employer sponsored retirement system has evolved significantly over the past 125 years. Today it is a vital component of American's $10 trillion retirement market (McCourt, 2006). Although there is an increasing trend towards shifting from defined benefit (DB) plans to defined contribution (DC) plans (Mitchell, 2002), DB plans still account for a significant portion of total pension assets. According to a U.S. Department Labor annual report (Private Pension Plan Bulletin, March 2007), at the end of year 2004 the total asset of DB plans with 100 or more participants stood at $2.08 trillion, close to the $2.13 trillion of total assets of DC plan with 100 or more participants.

DB pension plans once again are of special interest to investors, lawmakers, accounting standard setters, and participants, at least in part because of the estimated overall funding shortfall following the 2002-2004 stock market decline period, during which DB plans experienced a $400 billion deterioration. Consequently, many DB pension plans shifted from an overfunded status to an underfunded status.

To protect employees' retirement benefit, the Employee Retirement Income Security Act (ERISA) of 1974 instituted a minimum funding requirement for underfunded plans. ERISA rules require that the sponsors of underfunded plans must make annual installment payments on any unfunded liability in addition to contributing an amount equal to the present value of pension benefits accrued during the year.

The Pension Protection Act of 1987 further tightened the funding requirement rules of DB plans, requiring underfunded plan to deposit between 13.75%-30% of any underfunding as a "catch-up" or deficit reduction contribution (DRC). The larger the funding deficit, the higher the percentage of the deficit that must be contributed in the first year, with the remainder being amortized over three to five years (Rauh, 2006).

The 1994 Retirement Protection Act (RPA) further tightened funding requirements. It increased the minimum DRC rate from rate from 13.75% to 18% for years beginning after January 1, 1995. However, it exempted plans that are more than 90% funded, as well as plans that are funded between 80% and 90%, provided that those plans were at least 90% funded in two consecutive years out of the preceding three years.

Firms that fail these funding criteria must make mandatory contributions to reduce their pension liability. The MC could have a large impact on a firm's cash flow that in turn could limit its capacity to invest and expand. Rauh (2006) first examines MC effects on capital expenditure. Using the schedule B data from 1990 to 1998, he finds that firms' capital expenditure decline when MC requirements come into play, even when controlling for correlations between the pension funding status itself and the firm's unobserved investment opportunities. The decline is sharper for firms that appear more constrained or more dependent on external finance. Previous findings show that capital expenditures are value-relevant. Callen et al (1996) find that firms with large ratios of current to prior four-year average capital expenditures experience positive current-period abnormal returns. Lev and Thiagarajan (1993) document that capital expenditures are value-relevant after controlling for industry differences. Kim (2001) examines the relation between capital expenditures and future earnings after controlling for the effect of previous capital expenditures and other possible omitted variables. He finds that firms with (without) at least one year of losses in the next five years exhibit a strong negative (positive) linear association between capital expenditures and future earnings. These results imply that MC could adversely influence firms' earnings and returns by impacting capital expenditures.

Franzoni (2008), using the same data set as Rauh (2006), investigates whether the sensitivity of investment to financial slack depends on firms' funding status, underinvestment or overinvestment. He finds that the market reacts significantly more strongly to a drop in cash that affects a financially constrained firm. His results also show

that for firms with entrenched managers and less institutional presence, the price reaction to a given drop in cash is significantly smaller in absolute value, consistent with empire-building theories. Since his main interest is to test whether the price reaction to MC is associated with financial constraints or to empire building, Franzoni (2008) does not investigate the effect of MC on investor valuation. Furthermore, his data is limited to a relatively short period from 1990 to 1998.

2.2. Market Reactions, Analyst Forecasts and Institutional Holdings

SFAS 87 requires firms to report meaningful information about their pension plans in detailed footnotes when filing financial reports. This should allow investors to obtain information on pension fund performance and condition. However, as pointed out by Peter Fortune (2005), only financial analysts and attentive investors, skilled at decoding accounting statements, can scrutinize the notes to corporation's financial statements and adjust both income statements and balance sheets to reflect the actual state of DB pension plans. Part of the complexity arises because of the SFAS 87 smoothing assumptions (meant to prevent the financial statements of firms from being severely influenced by the high volatility of pension earnings), and the fact that DB plans are subject to three separate sets of regulations, GAAP as laid out in SFAS 87 and SFAS 132 for financial reporting, Section 412 of tax codes and rules of Pension Benefit Guaranty Corporation (PBGC) for insurance premiums (Picconi, 2004). As a result, pension accounting seems complex and confusing and required adjustments may not be fully embedded into market prices. Shareholders might incorrectly assess the current state of the firm's finances. Coronado and Sharpe (2003) find that investors appear to incorrectly judge the permanence of pension earnings and therefore treat pension earnings as core earnings, resulting in firm overvaluations. Even as DB pension plans have gained great attention in recent years since the burst of market bubble caused the funding status of pensions to change from surpluses to huge deficits, investors still misprice pension plan

firms. Coronado et al. (2008) test whether increased investor attention to pension account information has eliminated systematic mispricing in recent years. They show that investors continue to misvalue DB pensions, i.e., equity prices of firms still fail to reflect the true economic value of pension assets and liabilities.

Davis-Friday, et al. (1999) investigate the valuation of post retirement benefit (PRB) liabilities and find that PRB liabilities receive greater weight when recognized than disclosed. Franzoni and Martin (2006) study market efficiency and pension plan funding by examining the market response to firms with underfunded and overfunded DB pension plans. They find that firms with severely underfunded pension plans are significantly overvalued by the market. Liu and Tonks (2009) study the relationship between pension fund deficits and stock market efficiency in the UK and find that firms with better funded pension schemes earn higher return regardless of the size of the firm and firms with the severely underfunded pension schemes earn negative abnormal returns even for firm with high book-to-market ratio.

Plumlee (2003) shows that analysts' assimilation and weighting of the information can be affected by the complexity of disclosed information. Picconi (2004) finds that both analysts and investors fail to incorporate information that is already available in the pension notes. Investors tend to fully incorporate the portion of a firm's funded status that has been recognized as income but to improperly weight the off-balance sheet liability that is disclosed in the footnotes. Since analysts are specialized financial professionals and serve as intermediaries between firms and the market, their forecasts represent a good proxy for the market's expectation of future earnings (La Port 1999) and serve as an mechanism for stock price discovery (Gleason and Lee, 2003). Thereafter, Chen et al. (2008) employ analyst forecast errors and revisions to investigate whether stock returns fully reflect the implications of pension underfunding and find that analysts underreact to the information content of pension underfunding and fail to anticipate the decline in future earnings and cash flows for firms that experience seriously

underfunded pensions when they forecast corporate earnings.

Institutional investors are sophisticated and responsible for large amounts of money. Therefore, they are likely to pay more attention to the firms they are going to invest in or that they currently hold. Since they buy or sell large volumes of shares, their movements have an impact on the managers of the firms as well as the stock market. Bushee (1998) shows that managers are significantly less likely to cut R&D to reverse earning decline when institutional ownership is high. Hribar, Jenkins and Wang (2006) examines how institutional investors respond to accounting restatements and find that transient investors reduce their holdings in a restating firm at least one quarter prior to the quarter of the restatement. Franzoni (2008) investigates firms with pension plans and finds that overinvested firms appear to be larger, older, more covered by analysts and rating agencies, and to display less institutional ownership. These studies show that institutional investors not only discern firm "types" and adjust their holding levels accordingly, but they also influence the behavior of the firm that could in turn affect the performance of pension fund and market returns.

In summary, the existing literature reveals that pension accounting is complex and opaque, and thus impacts market assessment of the value of the company. Underfunded DB plans seem to contribute the firms' low market returns, decrease analysts' forecasting accuracy and possibly affect institutional holdings. However, there is little evidence on how professional market participants such as analysts and institutional investors respond to MC. This study attempts to fill this gap by investigating the effects of MC on stock market returns, analyst forecasts and institutional holdings using the actuarial mandatory contribution defined as "Additional Required Funding Charge" from schedule B of Form 5500 filed by firms from 1991 through 2005. This is a more direct measure of the additional mandated contribution than that used by the two studies discussed earlier (Rauh 2006 and Franzoni 2008).

CHAPTER 3

DATA AND METHODOLOGY

3.1 Data Descriptions

Data used in this study have been collected from several sources. I first obtain the plan mandatory contribution information from schedule B of Form 5500 filed with the Department of Labor from1991 through 2005, and then merge the data with financial statement data from Standard Poor's Compustat, stock market data from Center for Research in Security Prices (CRSP), analyst forecast data from Thomas Reuters' I/B/E/S, and institutional holdings data from Thomson Reuters' CDA/Spectrum Institutional (13f) Holdings. All firms, no matter whether publicly traded or privately owned, have to file Form 5500 every year for every pension benefit plan, welfare plan, fringe benefit plan and direct filing entity. The employer or plan administrator of defined benefit plan that is subject to the minimum funding status must file Schedule B of Form 5500 for the plan year to report the plan's actuarial information. The actuary must certify the minimum required contribution (MRC)[1] to prevent an accumulated funding deficiency in the plan's Funding Standard Account (FSA). The MRC is generally equal to the sum of the "normal cost" (the present value of pension benefits accrued during the year) and the amortized amount of accrued liability, reduced by the FSA credit balance.

The FSA is used to track contributions made by a plan sponsor in excess of the MRC. Then the actuary determines the plan's additional required funding charge based on the "Gateway" percentage, defined as a proportion of plan's current assets to its current liabilities. If the plan is underfunded and its Gateway percent is below the specified level, it is subject to the DRC requirement, as discussed earlier. The additional funding charge is then calculated as the excess of the DRC over the sum of various

[1] The MRC is the "Amount of contribution certified by the actuary as necessary to reduce the funding deficiency to zero" derived from the FSA statement in Schedule B.

charges and credits in the FSA, adjusted for any "unpredictable contingent event amount" for the plan year. For a plan that has more than 100 but fewer than 150 participants the additional funding charge is further reduced 2 percent for each participant less than 150. The adjusted additional funding charge, reported on line 13 of Schedule B for years before 1995 and on the last line in part II of Schedule B since 1995, is my mandatory contribution (MC) variable.

I then aggregate the plan-year MC to firm-year level. Panel A of Table 1 shows the number of firms and large plans in Schedule B of 5500 from 1991 to 2005. Only partial data were available for the year 2005 at the time these data were collected from the Department of Labor. Although it fluctuates from year by year, the number of firms sponsoring large DB plans with 100 or more participants shows a decreasing trend, from 14,807 firms in 1991 to 10,547 in 2004. However, the average number of plans per firm over the period remains stable with the overall average of 1.4 plans per firm.

Panel B of Table 1 shows the number of firms with large plans in Schedule B of Form 5500 from 1991 to 2005, after merging with Compustat data. Only 13.9% firm-years in Panel A remain in Compustat, implying that most of the firms that filed Schedule B of Form 5500 are private firms. However, the average number of plans per firm increases to 1.9, indicating that the public traded firms sponsor more DB plans than private firms.

3.2. Pension Variable Definitions

The pension variables used throughout this paper are defined in Table 2. Panel A lists variables derived from Compustat data, Panel B lists variables obtained from Schedule B of Form 5500 and Panel C lists variables calculated from both Compustat and Schedule B of Form 5500.

Table 1. Descriptive Statistics for Firms with Defined Benefit (DB) Plans with 100 or More Participants (Schedule B of Form 5500).

Panel A. Before Merging with Compustat Data.

Year	Number of Firms	Number of Plans	Average Plans Per Firm	Number of plans per firm		
				Min	Max	Std
1991	14807	19646	1.3268	1	59	1.4283
1992	10482	13735	1.3103	1	36	1.3012
1993	13912	18193	1.3077	1	57	1.3823
1994	11062	14522	1.3128	1	57	1.3770
1995	13062	16888	1.2929	1	50	1.2074
1996	12728	16325	1.2826	1	34	1.1208
1997	12191	15625	1.2817	1	30	1.0842
1998	11673	14830	1.2705	1	29	1.0526
1999	10120	13928	1.3763	1	31	1.2476
2000	12052	16077	1.3340	1	27	1.1456
2001	11607	15226	1.3118	1	40	1.1010
2002	11059	14749	1.3337	1	29	1.0980
2003	10951	17812	1.6265	1	32	1.3472
2004	10547	16959	1.6079	1	39	1.2701
2005	3445	4632	1.3446	1	31	1.1122
Overall	169698	229147	1.3503	1	59	1.2373

Panel B. After Merging with Compustat Data.

Year	Number of Firms	Number of Plans	Average Plans Per Firm	Number of plans per firm		
				Min	Max	Std
1991	2001	4074	2.0360	1	59	2.9364
1992	1523	2968	1.9488	1	36	2.5661
1993	1955	3786	1.9366	1	57	2.6866
1994	1661	3151	1.8970	1	57	2.6850
1995	1889	3513	1.8597	1	50	2.2218
1996	1871	3356	1.7937	1	32	1.9628
1997	1817	3274	1.8019	1	30	2.0187
1998	1749	3169	1.8119	1	29	2.0809
1999	1348	2534	1.8798	1	24	2.2116
2000	1562	2930	1.8758	1	26	2.2039
2001	1481	2725	1.8400	1	29	2.1097
2002	1436	2595	1.8071	1	29	2.0872
2003	1422	2490	1.7511	1	28	1.9577
2004	1362	2293	1.6836	1	32	1.8557
2005	531	891	1.6780	1	31	2.1368
Overall	23608	43749	1.8531	1	59	2.2972

Table 2. Pension Variable Definitions.

Panel A. Variables from Compustat.

Variable	Description
TA	Total Assets
MktCap	Market Capitalization
NOA	Net Operating Assets /lag(TA)
TotAccru	Total Accruals /lag(TA)
NI	Net Income/lag(TA)
OCF	Operating Cash Flow/lag(TA)
R&D	Research and Development/lag(TA)
CapExp	Capital Expenditure/lag(TA)
Acquisn	Acquisition/lag(TA)
Dividend	Dividend/lag(TA)
LTD	Long Term Debt/lag(TA)
LTDissue	Long Term Debt Issue/lag(TA)
FV	Fund Market Value of Pension Asset
PBO	Projected Benefit Obligation
FvToTa	Fund Market Value of Pension Asset to Total Asset
PboToTa	Projected Benefit Obligation to Total Asset
FvToPbo	Fund Market Value of Pension Asset to PBO
FR	Funding Ratio = (FV-PBO) / lag(MktCap)
Fstatus	Fund Status = (FV- PBO) /lag(TA)
OBSliab	Off Balance Sheet Liabilities/lag(TA)
CompRate	Compensation Rate/lag(TA)
DiscRate	Discount Rate/lag(TA)
IntCost	Interest Cost/lag(TA)
PenCost	Pension Cost/lag(TA)
ServCost	Service Cost/lag(TA)
OthPCost	Other Pension Cost Items/lag(TA)
PriorSC	Prior Service Cost/lag(TA)
ERR	Expected Rate Return
RET	Stock market return
ROA	Return on Asset
ROE	Return on Equity

Table 2. (Continued)

Panel B. Variables from Schedule B of Form 5500.

Variable	Description
CurAst	Fund Current Assets
CurLia	Fund Current Liability
MC	Mandatory Contribution (Amount)
DRC	Deficit Reduction Contribution (Amount)
MRC	Minimum Required Contribution (Amount) To Avoid Fund Deficiency
OldLia	Unfunded Old Liability (Amount)
NewLia	Unfunded New Liability (Amount)
GWAY	Gateway, Ratio of Fund Current Assets to Current Liability
McToCurAst	Mandatory Contribution to Fund Current Assets
MrcToCurAst	Minimum Required Contribution to Fund Current Assets
DrcToCurAst	Deficit Reduction Contribution to Fund Current Assets
OldLiaToCurAst	Unfunded Old Liability to Fund Current Assets
NewLiaToCurAst	Unfunded New Liability to Fund Current Assets
McToCurLia	Mandatory Contribution to Fund Current Liability

Panel C. Variables from Compustat and Schedule B of Form 5500.

Variable	Description
McToTa	Mandatory Contribution in Schedule B to TA in Compustat
DrcToTa	Deficit Reduction Contribution in Schedule B to TA in Compustat
MrcToTa	Minimum Fund Contribution in Schedule B to TA in Compustat
OldLiaToTa	Unfunded Old Liability in Schedule B to TA in Compustat
NewLiaToTa	Unfunded New Liability in Schedule B to TA in Compustat
CurAstToTa	Fund Current Assets in Schedule B to TA in Compustat
CurLiaToTa	Fund Current Liability in Schedule B to TA in Compustat
McToFV	Mandatory Contribution in Schedule B to Fund Value in Compustat
McToPbo	Mandatory Contribution in Schedule B to PBO in Compustat
CurAstToFV	Fund Current Assets in Schedule B to Fund Value in Compustat
CurLiaToPbo	Fund Current Liability in Schedule B to PBO in Compustat
FVToPbo	Fund Market Value to Projected Benefit Obligation in Compustat

3.3 Methodology

3.3.1 Grouping Strategy

Most portfolio analyses use firm-year strategy by grouping firms yearly based on some criteria. The same firm-year grouping strategy is used by Rauh (2006) when examining the capital expenditures of MC firms and Franzoni (2008) when investigating the market assessments of financial constraints due to MC. The drawback of the firm-year grouping is that it pools together all MC firms in a given year without differentiating between firms making MC just once, or sporadically, from those with recurring MC commitments. Firms that are subject to the MC requirement just once may have the financial strength to recover from the pension liability shortfall, while firms with longer term MC requirements may not. Analyzing these firms together will confound the estimated results and perhaps underestimate the MC effect.

My analyses follow a two-pronged strategy. First, I focus on a subset of MC firms with a single, uninterrupted string of MC payments with lengths varying from one to six or more consecutive years and analyze whether the implications of the MC string length are impounded in stock market returns, in the forecasts and revisions of analysts, and in the holdings of different classes of institutional investors. Second, I examine the characteristics of MC firms with multiple years and periods of MC, using factor analysis and then cluster analysis to group MC firms into clusters. I then repeat my analyses on the identified clusters along with two additional groups of firms: those with no mandatory contributions during the sample period (NMC) and those with just one year of MC payments (ONCE).

3.3.2 Market Reactions

To examine market responses, I use market, three-factor (Fama and French, 1993)

and four-factor (Jegadesh and Titman, 1993) time-series regressions to obtain alphas and factor loadings for each group.

$$R_{i,t} = \alpha_i + b_i EXM_t + e_{i,t} \quad (1)$$

$$R_{i,t} = \alpha_i + b_i EXM_t + h_i HML_t + s_i SMB_t + e_{i,t} \quad (2)$$

$$R_{i,t} = \alpha_i + b_i EXM_t + h_i HML_t + s_i SMB_t + m_i UMD_t + e_{i,t} \quad (3)$$

In the above models, subscript i represents each MC firm group and t represents time. R is the firm's return in a group; EXM, HML, SMB and UMB represent market, book-to-market, size and momentum factors[2]. Then, I calculate the risk adjusted returns using the estimated coefficients from the above models.

3.3.3 Analyst Forecasts and Revisions

Starting with the first quarter after the first MC fiscal year for a given firm, I use the I/B/E/S detail file to calculate mean/median analyst earnings forecasts and forecast errors, number of revisions, mean/median revision values and analyst following in the following quarters. Forecasted mean and median values are calculated from the most recent estimates for all analysts in the forecasted quarter. Analyst following is defined as the number of analysts who make at least one estimated forecast in the quarter.

I use forecast error and absolute value of forecast error to examine analysts' forecast accuracy. Forecasted error (mean or median) is defined as:

$$FE_{i,q} = (FEPS_{i,q} - AEPS_{i,q}) / P_{i,q-1} \quad (4)$$

Where, subscript i and q represent firm i and quarter q. FE is the analyst's forecast error and FEPS is the analyst' earnings forecasts per share calculated from I/B/E/S detailed file, AEPS is the actual earnings per share announced by the firm, and P_{q-1} is the stock price at previous quarter.

[2] I thank Ken R. French for these Factors which are downloaded from his data library website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Absolute value of forecast accuracy is defined as:

$$AbsFE_{i,q} = |(FEPS_{i,q} - AEPS_{i,q})| / P_{i,q-1} \quad (5)$$

Where, for firm i, $AbsFE_{i,q}$ is the absolute value of forecast error at quarter q, $FEPS_{i,q}$ and $AEPS_{i,q}$ are the same as defined above.

Number of revisions is the total number of revisions made by all analysts in one quarter. Mean revisions are calculated as:

$$REV_{i,q} = \sum_a \sum_t (FEPS_{i,q,a,t} - FEPS_{i,q,a,t-1}) / NREV_{i,q} \quad (6)$$

Where $REV_{i,q}$ is the mean revision for firm i in quarter q, $FEPS_{i,q,a,t}$ is analyst a's forecast for firm i in quarter q at time t, $FEPS_{i,q,a,t-1}$ is analyst a's forecast for firm i in quarter q at time t-1 ant $NREV_{i,q}$ is the total number of revisions of all analysts for firm i and quarter q.

3.3.4. Institutional Holdings

Using the institutional investor information from 13(f) filings and shares outstanding from CRSP, I define PIH and CPIH as:

$$PIH_{i,q} = ISHARES_{i,q} / TSHARES_{i,q} \quad (7)$$

$$CPIH_{i,q} = ICSHARES_{i,q} / TSHARES_{i,q} \quad (8)$$

Where $PIH_{i,q}$ is the percentage of institutional holdings for firm i in quarter q, $ISHARES_{i,q}$ is the total shares held by institutional investors for firm i in quarter q, $TSHARES_{i,q}$ is the total shares outstanding for firm i in quarter q, $CPIH_{i,q}$ is the changes of percentage of institutional holdings firm i in quarter q, and $ICSHARES_{i,q}$ is the change of shares for firm i from previous quarter to the current quarter.

To investigate the influence of institutional investor class and style, I classify institutional investors into three classes and four styles based on the classification used in Bushee[3](2001) and Abarbanee, Bushee and Raedy (2003).

[3] I am grateful to Brian Bushee for providing the institution classification codes.

The three classes of institutional investors are defined as DED, QIX and TRA.

DED = Dedicated investors, who have low turnover and more concentrated portfolio holdings.

QIX = Quasi-indexer investors, who have low turnover and diversified portfolio holdings.

TRA = Transient investors, who have high portfolio turnover and diversified portfolio holdings.

The four styles of institutional investors are defined as LVA, LGR, SVA and SGR.

LVA = Large-Value investors, who prefer large firms, which are high on the value and fiduciary dimensions and low on historical growth-risk dimension.

LGR = Large-Growth investors, who hold large firms with greater future growth potential than firms held by large-value investors.

SVA = Small-Value investors, who prefer small-cap firms (though not as small as small-growth funds) that are high on the value dimension and low on the prior growth risk dimension.

SGR = Small-Growth investors, who prefer small-cap firms that are high on the growth dimension.

CHAPTER 4

DESCRIPTIVE STATISTICS

Panel A of Table 3 reports the firm-year distributions of large DB plans by industry. For all firm-years, the top three industries that sponsor most large DB plans are Financial Services (13.94%), Transportation (9.86%) and Utilities (9.37%), while the bottom three are Software (0.93%), Real Estate (1.04%) and Miscellaneous Manufacturing (1.22%). However, for MC firm-years, Transportation (14.67%), Metal (11.08%) and Machinery (10.34) are the three most prevalent industries. In terms of firm distributions, Panel B of Table 3 shows the same top and bottom three industries as shown in Panel A. The results reveal a great deal of variation among industries in sponsoring large DB plans and being subject to the MC requirement. The Financial Services industry sponsors the most DB plans, while the Transportation industry is the most heavily represented among MC firms. Further investigation finds that, within the Transportation industry, airlines represent the largest MC sub-industry. As reported by GAO (2004), airlines have faced considerable debt and pension fund obligation because their financial performance has deteriorated significantly since 2000.

Table 4 shows the distributions of all firms from Schedule B of Form 5500, sorted by number of MC years and periods, with period defined as an interval of consecutive MC years. The data in Table 4 indicate that 1,449 firms (54% of the sample) are not subject to the MC requirement during the entire sample period, and there are 369 firms that were subject to the additional funding requirement for one year only. Of the 200 firms with two MC years, 138 firms have one continuous two-year period when they were subject to the MC requirement, while 62 firms have two separate MC periods of one year each. The maximum number of MC periods is 7 and the maximum number of MC years is 15. Of the 1218 MC firms, 369 firms (31%) have only one MC year and 734 firms (60%) have

Table 3. Industry Breakdown for Mandatory Contribution (MC) and Non-Mandatory Contribution (NMC) Firms.

Panel A. Firm-Year Distribution of MC and NMC Across Industries.

Industry	First Two or Four Digits of SIC	MC Firm-Years		NMC Firm-Years		All Firm-Years	
		n	pct	n	pct	n	pct
Mining, Oil and Gas, Construction	10,12,13,14	87	1.96	496	2.59	583	2.47
Food, Tobacco	20,21	208	4.70	841	4.39	1049	4.44
Textile, Apparel	22,23	149	3.36	383	2.00	532	2.25
Lumber, Furniture, Paper, Printing	24-27	353	7.97	1171	6.11	1524	6.46
Chemicals and Allied Products	28	284	6.41	1241	6.47	1525	6.46
Rubber, Plastics, Leather, Glass	30-32	288	6.50	753	3.93	1041	4.41
Metal Industries	33-34	491	11.08	979	5.10	1470	6.23
Machinery	35	458	10.34	1088	5.67	1546	6.55
Electrical Equipment	36	246	5.55	773	4.03	1019	4.32
Miscellaneous Manufacturing	39	64	1.44	223	1.16	287	1.22
Transportation	37,38,40-47	650	14.67	1678	8.75	2328	9.86
Communications	48	50	1.13	588	3.07	638	2.70
Utilities	49	92	2.08	2120	11.05	2212	9.37
Durable goods wholesale	50,51	156	3.52	745	3.88	901	3.82
Retail trade	52-59	205	4.63	883	4.60	1088	4.61
Financial services	60-64	137	3.09	3155	16.45	3292	13.94
Software	7370-7375	41	0.93	179	0.93	220	0.93
Real Estate	65-67	52	1.17	194	1.01	246	1.04
Others	Otherwise	419	9.46	1688	8.80	2107	8.92
Overall		4430	100.00	19178	100	23608	100.00

Panel B. Distribution of MC and NMC Firms Across Industries.

Industry	First Two or Four Digits of SIC	MC Firms		NMC Firms		All Firms	
		n	pct	n	pct	n	pct
Mining, Oil and Gas, Construction	10,12,13,14	31	2.55	38	2.62	69	2.59
Food, Tobacco	20,21	56	4.61	46	3.17	102	3.82
Textile, Apparel	22,23	34	2.80	28	1.93	62	2.32
Lumber, Furniture, Paper, Printing	24-27	84	6.91	67	4.62	151	5.66
Chemicals and Allied Products	28	85	6.99	73	5.03	158	5.92
Rubber, Plastics, Leather, Glass	30-32	71	5.84	36	2.48	107	4.01
Metal Industries	33-34	108	8.80	48	3.31	155	5.81
Machinery	35	106	8.72	56	3.86	162	6.07
Electrical Equipment	36	67	5.51	46	3.17	113	4.24
Miscellaneous Manufacturing	39	20	1.64	15	1.03	35	1.31
Transportation	37,38,40-47	139	11.43	101	7.03	241	9.04
Communications	48	20	1.64	59	4.07	79	2.96
Utilities	49	47	3.87	184	12.68	231	8.66
Durable goods wholesale	50,51	45	3.70	46	3.17	91	3.41
Retail trade	52-59	63	5.18	58	4.00	121	4.54
Financial services	60-64	74	6.09	358	24.67	432	16.20
Software	7370-7375	13	1.07	13	0.90	26	0.97
Real Estate	65-67	12	0.99	14	0.96	26	0.97
Others	Otherwise	143	11.68	163	11.30	306	11.47
Overall		1216	100.00	1449	100	2667	100.00

Table 4. Distribution of Firms' Mandatory Contribution (MC) by Number of Years and Number of Periods.

		Number of Years of MC																	%
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Sub Total	
Number of MC Periods	0	1449	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1449	0.543
	1	0	369	138	82	69	40	22	18	14	9	7	2	5	5	2	3	785	0.294
	2	0	0	62	71	41	27	29	15	14	11	9	9	5	2	4	0	299	0.112
	3	0	0	0	12	22	11	14	16	8	3	10	5	3	0	0	0	104	0.039
	4	0	0	0	0	5	4	9	3	0	2	0	2	0	0	0	0	25	0.009
	5	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	3	0.001
	6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.000
	7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.000
	Sub Total	1449	369	200	165	137	83	74	53	38	26	26	18	13	7	6	3	2667	
	%	0.543	0.138	0.075	0.062	0.051	0.031	0.028	0.020	0.014	0.010	0.010	0.007	0.005	0.003	0.002	0.001		1.000

one to three MC years. There are three firms that are subject to the MC requirement every year. Table 4 shows a large variation of MC years and MC periods among the MC firms and provides further evidence of the importance of taking this variation into consideration in portfolio analyses.

The results of Table 5 show the frequency, fund market value of pension assets (FV), projected benefit obligation (PBO), total assets (TA) and ratios of FV to PBO (FvToPbo), FV to TA (FvToTa) and PBO to TA (PboToTa) for firms with different number of plans filed from 1991 to 2005. Panel A shows statistics for all firms. The number of plans sponsored by a firm ranges from 1 to 57 and the majority of firms (90%) sponsor one to three plans. One-plan firms account for 65% of total firms during this period. But the proportion of FV of one-plan firms is 47%, indicating the fund value of one-plan firms is relatively small. The mean FV ($343 million) of one-plan firms is indeed small in comparison to the overall mean FV ($472 million). The PBO of these one-plan firms is also small, making their FvToPbo close to 97%. But the mean asset value of these firms is close to the overall mean, indicating these firms are not necessarily small firms. As the number of plans increases, the FvToTa shows a generally increasing trend until the number of plans reaches 23. The largest FvToTa is 67% for a firm sponsoring 23 plans and the same firm also possesses the largest PboToTa (66%). The overall average of FvToPbo presented in the last row is 97.9%, indicating that on average plan fund value is only 2.1% below the pension obligation. The last row also shows that FV and PBO account for 15% of total assets but the two proportions vary greatly for firms with different number of plans.

Panel B shows statistics for NMC firms. In comparison with the data in Panel A, the maximum number of plans sponsored by NMC firms is 20. In addition, the proportion of one-plan firms is 5% higher and the proportion of firms with one to three plans is 3% higher than the corresponding statistics for all firms shown in Panel A. Overall, the data

Table 5. Descriptive Statistics for Selected Pension Variables.

Means are in millions of dollars.

Panel A. All Firms that File Schedule B of 5500 and Have FV, PBO and TA Data in Compustat.

Number	Frequency		FV		PBO		TA		RATIO		
of Plans	n	pct	mean	pct	mean	pct	mean	pct	FvToPbo	FvToTa	PboToTa
1	9748	0.6495	343	0.4747	344	0.4720	5086	0.6608	0.9682	0.1299	0.1308
2	2838	0.1891	514	0.2041	559	0.2207	4668	0.1636	0.9940	0.1890	0.1862
3	985	0.0656	725	0.1002	734	0.1005	4810	0.0578	0.9894	0.1953	0.1942
4	432	0.0288	708	0.0433	736	0.0446	4090	0.0216	0.9843	0.2148	0.2052
5	264	0.0176	1002	0.0373	931	0.0338	6676	0.0214	1.0078	0.2122	0.2076
6	173	0.0115	1324	0.0323	1237	0.0295	7620	0.0164	1.0085	0.2539	0.2475
7	142	0.0095	1308	0.0259	1025	0.0194	9518	0.0162	0.9815	0.2266	0.2196
8	88	0.0059	1321	0.0160	1393	0.0167	9518	0.0102	0.9668	0.2560	0.2490
9	78	0.0052	1982	0.0200	1695	0.0163	10909	0.0105	0.9993	0.2774	0.2775
10	58	0.0039	1413	0.0113	1536	0.0124	6139	0.0043	1.0587	0.2655	0.2501
11	40	0.0027	875	0.0049	833	0.0046	4063	0.0020	1.0535	0.2854	0.2708
12	33	0.0022	1131	0.0052	973	0.0044	5296	0.0021	1.1569	0.2570	0.2161
13	16	0.0011	1572	0.0034	1357	0.0029	6913	0.0013	1.1324	0.2030	0.1821
14	16	0.0011	582	0.0013	549	0.0012	3191	0.0006	1.0200	0.1586	0.1580
15	15	0.0010	484	0.0010	1159	0.0025	3689	0.0007	1.2852	0.2426	0.1973
16	10	0.0007	1583	0.0023	1711	0.0024	4009	0.0005	1.0084	0.3222	0.3451
17	11	0.0007	1268	0.0020	1047	0.0016	4854	0.0006	1.1763	0.2999	0.2523
18	7	0.0005	1246	0.0012	1100	0.0011	3104	0.0003	1.1272	0.3753	0.3284
19	7	0.0005	2526	0.0022	2736	0.0023	9447	0.0008	0.9798	0.4877	0.5419
20	9	0.0006	989	0.0013	1005	0.0013	4257	0.0005	0.9968	0.2265	0.2271
21	3	0.0002	1188	0.0005	1094	0.0005	3867	0.0001	1.1886	0.2901	0.2514
22	9	0.0006	2146	0.0015	1937	0.0014	16603	0.0018	1.0739	0.4882	0.4543
23	1	0.0001	3389	0.0005	3334	0.0005	5049	0.0001	1.0163	0.6712	0.6604
24	4	0.0003	3319	0.0014	2695	0.0011	18177	0.0009	1.2286	0.3797	0.3080
25	2	0.0001	3307	0.0009	2382	0.0007	9745	0.0002	1.3075	0.3684	0.2893
26	1	0.0001	2931	0.0004	2425	0.0003	11123	0.0001	1.2087	0.2635	0.2180
27	1	0.0001	3035	0.0004	3536	0.0005	54019	0.0007	0.8583	0.0562	0.0655
28	2	0.0001	2379	0.0007	2518	0.0007	12645	0.0003	0.9698	0.1948	0.2177
29	4	0.0003	2518	0.0007	2513	0.0007	19765	0.0010	1.1162	0.4564	0.3932
31	3	0.0002	3141	0.0013	3759	0.0016	46114	0.0017	0.8405	0.1359	0.1567
32	2	0.0001	2367	0.0003	2914	0.0004	13633	0.0003	0.9553	0.5154	0.5087
36	1	0.0001	357	0.0001	327	0.0000	1890	0.0000	1.0927	0.1888	0.1728
39	1	0.0001	448	0.0001	424	0.0001	1964	0.0000	1.0560	0.2282	0.2161
40	1	0.0001	398	0.0001	391	0.0001	1921	0.0000	1.0189	0.2073	0.2034
50	1	0.0001	3639	0.0005	3024	0.0004	23172	0.0003	1.2034	0.1570	0.1305
57	2	0.0001	3197	0.0009	2703	0.0008	19013	0.0005	1.1832	0.1681	0.1421
Total	15008	1.0000	472	1.0000	476	1.0000	5142	1.0000	0.9785	0.1557	0.1548

Table 5. (Continued)

Panel B. NMC Firms that File Schedule B of Form 5500 and Have FV, PBO and TA Data in Compustat.

Number	Frequency		FV		PBO		TA		RATIO		
of Plans	n	pct	mean	pct	mean	pct	mean	pct	FvToPbo	FvToTa	PboToTa
1	8862	0.7190	360	0.5551	356	0.5535	5407	0.7147	0.9898	0.1277	0.1261
2	2202	0.1786	593	0.2236	631	0.2407	5367	0.1634	1.0361	0.1850	0.1782
3	619	0.0502	915	0.0969	886	0.0944	6225	0.0527	1.0460	0.1979	0.1885
4	226	0.0183	790	0.0309	753	0.0297	4997	0.0154	1.0594	0.2335	0.2115
5	146	0.0118	1117	0.0280	1135	0.0286	7732	0.0153	1.0632	0.2174	0.1974
6	74	0.0060	1530	0.0200	1114	0.0142	8092	0.0086	1.1189	0.2644	0.2323
7	48	0.0039	1977	0.0158	1387	0.0102	16756	0.0106	0.9571	0.1768	0.1771
8	39	0.0032	1735	0.0112	1813	0.0118	14768	0.0079	1.0740	0.2588	0.2439
9	33	0.0027	1383	0.0063	1278	0.0058	14155	0.0065	1.0641	0.3259	0.3109
10	20	0.0016	1657	0.0058	1455	0.0051	7330	0.0020	1.1969	0.2454	0.2132
11	11	0.0009	486	0.0009	430	0.0008	1434	0.0002	1.1242	0.3863	0.3520
12	14	0.0011	751	0.0018	662	0.0016	4450	0.0008	1.1899	0.1895	0.1513
13	8	0.0006	386	0.0005	329	0.0005	4256	0.0005	1.2192	0.1184	0.0966
14	5	0.0004	436	0.0004	377	0.0003	3747	0.0003	1.1600	0.1225	0.1085
15	8	0.0006	186	0.0003	160	0.0002	1099	0.0001	1.4147	0.2193	0.1546
16	4	0.0003	1186	0.0008	1385	0.0010	3779	0.0002	0.9692	0.2891	0.3190
17	1	0.0001	3699	0.0006	2869	0.0005	18293	0.0002	1.2893	0.2022	0.1568
18	2	0.0002	395	0.0001	376	0.0001	1866	0.0001	1.1279	0.2125	0.1909
19	2	0.0002	3234	0.0006	3617	0.0006	15342	0.0004	0.8762	0.7581	0.8665
20	2	0.0002	877	0.0003	939	0.0003	4236	0.0001	0.9287	0.2170	0.2259
	12326	1.0000	469	1.0000	465	1.0000	5559	1.0000	1.0053	0.1471	0.1432

Table 5. (Continued)

Panel C. MC Firms that File Schedule B of Form 5500 and Have FV, PBO and TA Data in Compustat.

Number	Frequency		FV		PBO		TA		RATIO		
of Plans	n	pct	mean	pct	mean	pct	mean	pct	FvToPbo	FvToTa	PboToTa
1	850	0.3259	195	0.1350	239	0.1577	2221	0.2453	0.7665	0.1203	0.1556
2	619	0.2373	278	0.1381	306	0.1448	2117	0.1578	0.8507	0.1734	0.1999
3	360	0.1380	438	0.1268	420	0.1151	2482	0.1058	0.8934	0.1855	0.1947
4	201	0.0771	619	0.1009	718	0.1118	3096	0.0751	0.9016	0.1837	0.1982
5	114	0.0437	781	0.0724	672	0.0580	4697	0.0644	0.9295	0.2057	0.2203
6	98	0.0376	973	0.0731	1009	0.0716	5728	0.0645	0.9297	0.2360	0.2592
7	93	0.0357	864	0.0635	878	0.0617	5018	0.0542	0.9874	0.2520	0.2413
8	48	0.0184	1002	0.0384	1069	0.0392	5232	0.0298	0.8797	0.2311	0.2533
9	45	0.0173	1957	0.0673	1729	0.0541	8509	0.0455	0.9518	0.2418	0.2530
10	37	0.0142	1277	0.0368	1332	0.0366	5511	0.0243	0.9840	0.2760	0.2695
11	29	0.0111	1028	0.0230	991	0.0212	5060	0.0170	1.0267	0.2471	0.2400
12	17	0.0065	819	0.0111	1214	0.0167	5919	0.0131	1.0894	0.3068	0.2639
13	8	0.0031	1385	0.0066	2531	0.0135	9571	0.0089	1.0456	0.2875	0.2675
14	11	0.0042	648	0.0057	627	0.0053	2938	0.0038	0.9563	0.1751	0.1804
15	7	0.0027	881	0.0042	884	0.0040	6648	0.0054	1.1372	0.2692	0.2461
16	6	0.0023	1847	0.0089	1928	0.0088	4162	0.0029	1.0346	0.3443	0.3625
17	10	0.0038	1025	0.0082	865	0.0066	3510	0.0041	1.1650	0.3097	0.2618
18	5	0.0019	1586	0.0063	1389	0.0053	3599	0.0021	1.1270	0.4404	0.3833
19	5	0.0019	2384	0.0095	2560	0.0098	7089	0.0041	1.0213	0.3796	0.4120
20	7	0.0027	1020	0.0057	1024	0.0055	4263	0.0035	1.0163	0.2292	0.2275
21	3	0.0012	1188	0.0028	1094	0.0025	3867	0.0013	1.1886	0.2901	0.2514
22	9	0.0035	2146	0.0086	1937	0.0074	16603	0.0174	1.0739	0.4882	0.4543
23	1	0.0004	3389	0.0027	3334	0.0025	5049	0.0006	1.0163	0.6712	0.6604
24	4	0.0015	3319	0.0080	2695	0.0062	18177	0.0084	1.2286	0.3797	0.3080
25	2	0.0008	3307	0.0053	2382	0.0036	9745	0.0023	1.3075	0.3684	0.2893
26	1	0.0004	2931	0.0023	2425	0.0019	11123	0.0013	1.2087	0.2635	0.2180
27	1	0.0004	3035	0.0024	3536	0.0027	54019	0.0063	0.8583	0.0562	0.0655
28	2	0.0008	2379	0.0038	2518	0.0038	12645	0.0029	0.9698	0.1948	0.2177
29	4	0.0015	2518	0.0040	2513	0.0038	19765	0.0092	1.1162	0.4564	0.3932
31	3	0.0012	3141	0.0075	3759	0.0086	33892	0.0079	0.8405	0.1359	0.1567
32	2	0.0008	2367	0.0019	2914	0.0022	13633	0.0032	0.9553	0.5154	0.5087
36	1	0.0004	357	0.0003	327	0.0002	1890	0.0002	1.0927	0.1888	0.1728
39	1	0.0004	448	0.0004	424	0.0003	1964	0.0002	1.0560	0.2282	0.2161
40	1	0.0004	398	0.0003	391	0.0003	1921	0.0002	1.0189	0.2073	0.2034
50	1	0.0004	3639	0.0029	3024	0.0023	23172	0.0027	1.2034	0.1570	0.1305
57	2	0.0008	3197	0.0051	2703	0.0041	19013	0.0044	1.1832	0.1681	0.1421
	2608	1.0000	479	1.0000	503	1.0000	3127	1.0000	0.8603	0.1756	0.1963

show that MC firms tend to sponsor more pension plans. The FV and PBO are slightly lower and TA is 8% higher for NMC firms. On average, NMC firms are 0.5% overfunded with a fund surplus of $4 million.

Panel C shows corresponding statistics for MC firms. As suggested by the data in Panels A and B, more MC firms sponsor multiple plans. Firms that sponsor 21 plans or more are all MC firms. The proportion of firms sponsoring two or more plans increases to 67% for MC firms from 38% for NMC firms. The means of FV and PBO are slightly higher than those for NMC firms but the mean of TA is smaller, although a large variation is observed for firms with more than 21 plans. The size of MC firms is smaller in terms of total assets. The mean of FvToPbo shows that on average these firms are 14% underfunded with a deficit of $24 million on average. The average PboToTa is 2% higher than the average FvToTa, indicating that on average these firms need to contribute additional cash equal to 2% of their assets to meet their pension benefit obligation.

Table 6 presents descriptive statistics for NMC, MC, combined NMC and MC firms, and all firms in Compustat with pension data in the same period. The results show that NMC firms are in general healthier and more profitable than MC firms. NMC firms are larger, have more net income and operational cash flow, and pay higher dividend than MC firms. Recent studies by Zhang (2006) and Papanastasopoulos et al. (2007) show a negative relation between net operating assets (NOA) and future stock returns. The data in Table 6 show that NMC firms have lower NOA values than MC firms.

NMC firms spend more on R&D and capital expenditure but less on acquisitions. The combined NMC and MC firm sample spends 5.8% of the preceding year's total assets on capital expenditures, lower than the 6.8% ratio reported by Rauh (2006) who combines 5500 data with Compustat in the period 1990-1998. NMC firms have 4.6% less long term debt (LTD) and 1.8% less long term debt issuance (LTDissue) than MC firms.

Table 6. Descriptive Statistics Calculated from Compustat Data for Mandatory Contribution (MC) and Non-Mandatory Contribution (NMC) Firms, All NMC and MC Firms and All Compustat Firms.

All variables are winsorized to exclude extreme values outside of three standard deviations. TA, MktCap, FV and PBO are in millions of dollars and all other variables are expressed in ratios. See Table 2 for variable definitions.

	NMC Firms			MC Firms			All NMC and MC Firms			All Compustat Firms		
Variable	Mean	Median	Std	Mean	Median	Std	Mean	Median	Std	mean	median	std
TA	5559.1	1151.1	12853.5	3127.61	657.4	8777.4	5142.7	1050.6	12274.0	5319.2	789.4	15728.4
MktCap	3087.7	660.5	6805.5	2360.2	408.2	5732.2	2964.1	607.2	6640.8	2988.1	483.8	7827.4
NOA	0.5981	0.6512	0.2737	0.6253	0.6472	0.2615	0.6027	0.6505	0.2719	0.6092	0.6435	0.6607
TotAccru	-0.0513	-0.0486	0.0731	-0.0562	-0.0509	0.0862	-0.0522	-0.0490	0.0757	-0.0578	-0.0486	0.1513
NI	0.0399	0.0353	0.0726	0.0195	0.0303	0.0988	0.0364	0.0346	0.0781	0.0149	0.0305	0.2370
OCF	0.0939	0.0902	0.0704	0.0779	0.0774	0.0729	0.0909	0.0877	0.0712	0.0749	0.0797	0.1507
R&D	0.0302	0.0189	0.0336	0.0261	0.0171	0.0293	0.0293	0.0186	0.0327	0.0333	0.0165	0.0480
CapExp	0.0586	0.0496	0.0432	0.0535	0.0449	0.0385	0.0576	0.0487	0.0424	0.0585	0.0448	0.0585
Acquisn	0.0185	0.0000	0.0513	0.0210	0.0000	0.0541	0.0190	0.0000	0.0518	0.0216	0.0000	0.0792
Dividend	0.5420	0.3726	0.6202	0.3741	0.1100	0.5364	0.5131	0.3200	0.6099	0.4338	0.1500	0.6073
LTD	0.2270	0.2092	0.1851	0.2734	0.2463	0.2052	0.2348	0.2148	0.1894	0.2458	0.2059	0.2453
LTDissue	0.0892	0.0300	0.1529	0.1075	0.0359	0.1787	0.0925	0.0310	0.1581	0.1079	0.0255	0.2357
FV	468.59	87.10	1175.72	479.25	61.72	1288.31	471.95	82.62	1196.38	448.44	46.54	1251.82
PBO	465.19	87.26	1174.28	503.27	73.37	1379.28	475.85	84.70	1213.10	479.19	47.61	1397.24
FvToTa	0.1471	0.1039	0.1852	0.1756	0.1218	0.1968	0.1557	0.1064	0.1874	0.1184	0.0659	0.1598
PboToTa	0.1432	0.1050	0.1692	0.1963	0.1441	0.2008	0.1548	0.1104	0.1760	0.1216	0.0713	0.1604
FvToPbo	1.0053	0.9813	0.2556	0.8603	0.8570	0.2301	0.9785	0.9590	0.2569	0.9381	0.9256	0.2858
FR	0.0039	-0.0009	0.0996	-0.0294	-0.1486	0.1399	-0.0052	-0.0023	0.1131	-0.0012	-0.0018	0.1234
Fstatus	0.0032	-0.0005	0.0454	-0.0177	-0.0116	0.0508	-0.0004	-0.0016	0.0470	-0.0054	-0.0010	0.0470
OBSliab	-0.0033	0.0000	0.0285	0.0076	0.0058	0.0302	-0.0011	0.0007	0.0291	-0.0002	0.0000	0.0209
CompRate	0.0478	0.0500	0.7724	0.0479	0.0500	0.8252	0.0479	0.0500	0.7805	0.0398	0.0450	0.0019
DiscRate	0.0736	0.0750	0.7315	0.0750	0.0750	0.7656	0.0739	0.0750	0.7389	0.0628	0.0700	0.0025
IntCost	0.0105	0.0072	0.0117	0.0140	0.0101	0.0145	0.0111	0.0076	0.0123	0.0081	0.0071	0.0106
PenCost	0.0025	0.0018	0.0055	0.0049	0.0038	0.0059	0.0029	0.0021	0.0056	0.0028	0.0014	0.0061
ServCost	0.0045	0.0036	0.0038	0.0050	0.0044	0.0038	0.0046	0.0037	0.0038	0.0036	0.0020	0.0039
OthPCost	0.0032	0.0004	0.0131	0.0035	0.0009	0.0138	0.0032	0.0005	0.0132	0.0020	0.0009	0.0109
PriorSC	0.0033	0.0013	0.0057	0.0046	0.0028	0.0069	0.0036	0.0015	0.0060	0.0055	0.0000	0.0046
ERR	0.0882	0.0900	0.7630	0.0893	0.0900	0.8146	0.0883	0.0900	0.7729	0.0755	0.0850	0.0029
RET	0.0823	0.0565	0.3846	0.0161	0.0000	0.4136	0.0713	0.0461	0.3903	0.0682	0.0325	0.4449
ROA	0.0092	0.0085	0.0174	0.0043	0.0073	0.0236	0.0084	0.0083	0.0186	0.0037	0.0073	0.0451
ROE	0.0277	0.0311	0.1078	0.0161	0.0262	0.1383	0.0257	0.0306	0.1135	0.0178	0.0280	0.3341

The FV of NMC firms is higher than their PBO on average, resulting in overfunded pension plans on average. In contrast, FV of MC firms is lower than PBO, resulting in pension plans being 14% underfunded on average. The off-balance-sheet liability (OBSliab) for NMC firms is much smaller than MC firms. The results also show that compensation rate and discount rate of MC firms are higher than those of NMC firms. Further, MC firms have higher interest cost, pension cost, service cost, other pension cost and prior pension cost than NMC firms. Higher service cost in MC firms is expected since it is a function of compensation rate and discount rate (Picconi, 2004). Comparing the ERR and raw annual return, I find that the average ERR of NMC firms is only slightly higher than the annual return (8.8% vs 8.2%), but the average ERR of MC firms is far higher than the annual return (8.9% vs 1.6%). The managers of MC firms choose a higher ERR assumption than the NMC firms although the MC firms show less annual return.

MC firms are less profitable as shown by lower annual return (raw), ROA and ROE. Columns 8 to 10 show statistics for combined NMC and MC firms that file Schedule B of Form 5500, and the last three columns display the results for all Compustat firms with pension benefit plans. In general, the differences between the firms filing Schedule B and the Compustat firms with pension fund information are less prominent in non-pension fund characteristics than in pension fund characteristics. The firms with Form 5500 Schedule B filings have slightly lower values for total assets, market cap, R&D, capital expenditure, acquisition and LTD and higher NI, OCF and dividend values on average than the Compustat firms. Higher FV, FvToPbo, fund ratio (FR), and fund status values and lower PBO among the Form 5500 Schedule B firms show that these firms are better funded than the Compustat firms on average. These firms also show higher annual return (raw), ROA and ROE than Compustat firms with pension plans in general.

Figure 1 displays the pension fund status defined as FV/PBO -1 (Rauh, 2006) for Form 5500 Schedule B data and Compustat data. Lines above zero show the overfunded years, while lines below zero show the underfunded years. Although the two groups of firms show similar trends, firms with Form 5500 filings demonstrate slightly higher fund status. Both data show that in the three-year span from 1999 to 2002, pension fund status went from the best (10% overfunded in 1999) to the worst (25% underfunded in 2002). Following 2002, fund status starts recovering but slowly.

Table 7 shows the characteristics of MC firms. I define CurAst as the fund current asset value in Schedule B to distinguish it from FV, defined as the fund current asset value in Compustat. Since firms only file Form 5500 to report sponsored US pension funds, the difference between the two is the firms' global fund assets value plus the difference between the actuarial value and accounting values. Similarly, CurLia is the fund current liability in schedule B and PBO is the projected benefit obligation in Compustat. The CurAst of these firms is close to $260 million which is about 12% of total assets. The mandatory contribution of these firms is 2.65% of fund current assets ($6.9 million) and 0.19% of total assets. MRC, the minimum contribution required from employers at the Form 5500 filing date to prevent an accumulated funding deficiency in the plan's FSA, is close to 6% of CurAst, 2.24 times the corresponding MC ratio.

The unfunded old liability amount, OldLia, is .85% of fund assets, while the unfunded new liability amount, NewLia[4], accounts for 3.7% of fund assets. One of the

[4] I define NewLia as the unfunded new liability amount, which is a specified percentage of any unfunded new liability arising during the current period, The percentage is derived from a formula that takes into account the plan's funded status. The lower the funding status, the higher the proportion of the unfunded new liability that flows into NewLia.

Figure 1. Distribution of Pension Funding Status for Schedule B of Form 5500 Data and All Compustat Data.

The funding status is defined as pension assets (PA) minus pension liabilities, the projected benefit obligation (PBO), divided by PBO (Rau, 2006).

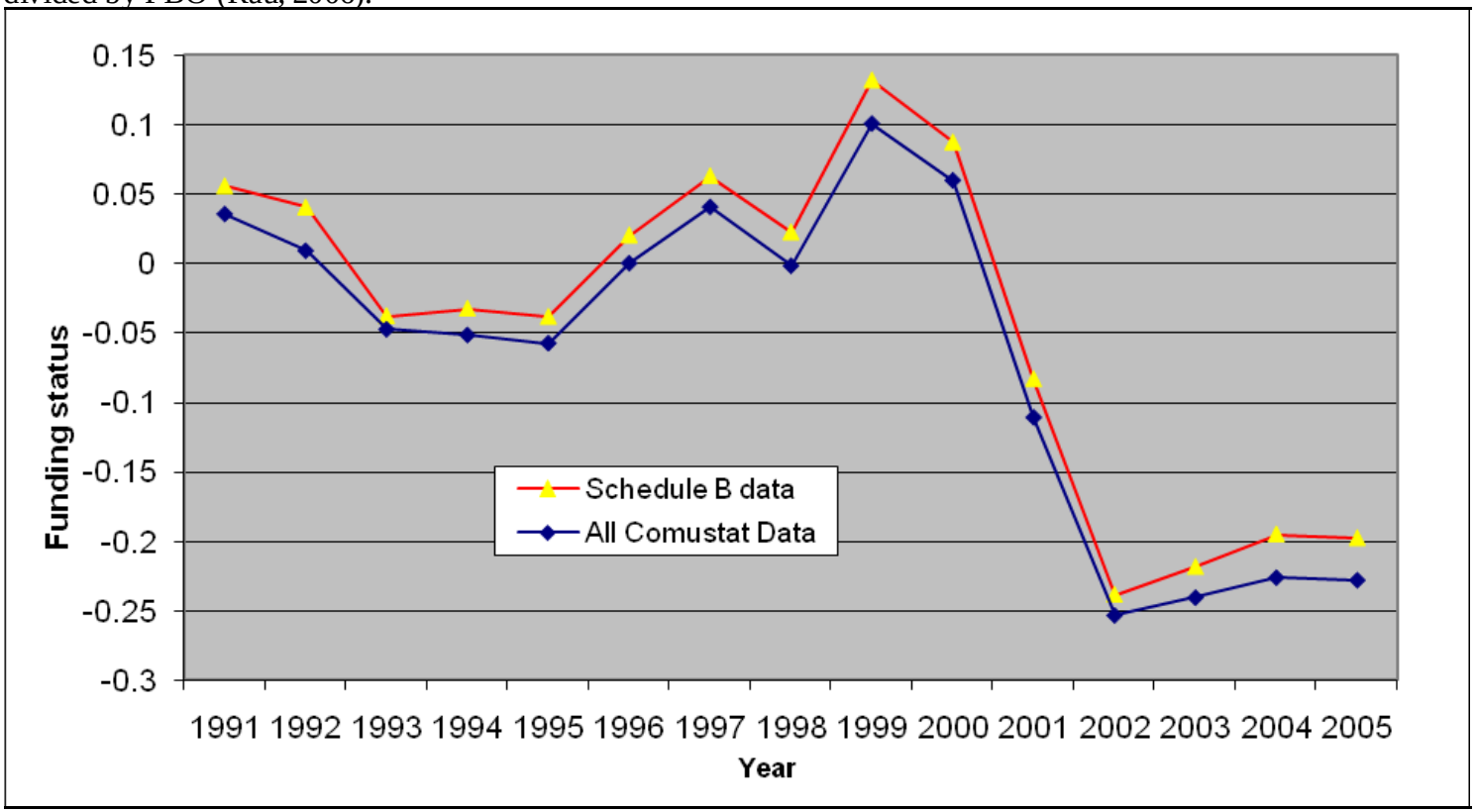


Table 7. Characteristics of Mandatory Contributions (MC) Firms from Schedule B of Form 5500 and Compustat Data.

All variables are winsorized to exclude the extreme values outside of three standard deviations. All variables are expressed in ratios except for CurAst that is in millions of dollars. See Table 2 for variable definitions.

	MC Firms		
Variable	mean	median	std
CurAst	259.52	28.82	893.62
McToCurAst	0.0265	0.0136	0.0351
DrcToCurAst	0.0646	0.0370	0.0784
MrcToCurAst	0.0593	0.0299	0.0944
OldLiaToCurAst	0.0085	0.0000	0.0180
NewLiaToCurAst	0.0372	0.0175	0.0507
McToCurLia	0.0218	0.0119	0.0413
GWAY	0.8832	0.8614	0.2017
McToTa	0.0019	0.0006	0.0035
DrcToTa	0.0046	0.0017	0.0076
MrcToTa	0.0131	0.0013	0.0308
OldLiaToTa	0.0007	0.0000	0.0022
NewLiaToTa	0.0025	0.0007	0.0051
CurAstToTa	0.1207	0.0777	0.1298
CurLiaToTa	0.1334	0.0858	0.1513
McToFv	0.0192	0.0082	0.0289
McToPbo	0.0145	0.0068	0.0203
CurAstToFv	0.8441	0.9302	0.3241
CurLiaToPbo	0.7829	0.8361	0.3184
FvToPbo	0.8595	0.8547	0.2174

reasons that NewLia is 4.31 times as high as OldLia is due to the shorter amortization period required for NewLia. The unfunded old liability amount is derived by amortizing the unfunded old liability (defined as the current liability of the first plan year after December 31, 1987), using equal installments of principal and interest over 18 years. The unfunded new liability before amortization (not shown in the table) is 4 times as large as NewLia, implying that the length of unfunded new liability amortization on average is 4 years. The amortization of NewLia is 4.5 times as fast as the amortization of the OldLia, closely approximating the ratio of NewLia to OldLia mentioned above. The data also indicate that DRC, the deficit reduction contribution, is about 2.3 times as large as MC. Overall, the data suggest that NewLia and DRC are the main drivers of MC.

GWAY, which is defined as the ratio of CurAst over CurLia and measures the funding percentage, shows that these firms' pension funds are only 88% funded, on average. Mandatory contribution of these firms to underfunded pension funds is equal to 0.19% of total assets, higher than the 0.1% reported by Rauh (2006) using data from 1990 to 1998 and defining the mandatory contribution as the maximum of DRC and MRC (with MRC estimated as normal cost plus 10% of the ERISA underfunding). One of the reasons for the difference could arise because this study utilizes the firms' actual MC for the year as reported in Schedule B of Form 5500, However, it is likely that the difference is mainly due to the dramatic drop in funding status after 2000 as shown in Figure 1.

The current value of US pension fund assets to total assets for MC firms is 12.1% , while the ratio of fund liability to total assets is 13.3%. There is a noteworthy difference between Compustat data and Schedule B of Form 5500 data as regards pension funding status. For MC firms, the Gateway percentage (Schedule B data) shows 2.3% higher pension funding than does FVtoPBO (Compustat data). The ratio

of fund current asset value for Form 5500 Schedule B firms is 15.6% lower than the corresponding Compustat value. In contrast, the ratio of fund current liability in Form 5500 Schedule B filings is 21.7% lower than for Compustat data. While the difference in the liability values from the two data sets is due to differences in the calculation of the pension liability (accumulated benefit obligation (ABO) in Schedule B and projected benefit obligation (PBO) in Compustat), and the PBO's inclusion of company's global pension plans, the significant differences across the two databases raises an interesting question. Is the difference solely due to reporting differences (i.e., PBO vs ABO values) or could firms be reporting lower (higher) pension liability (assets) in Schedule B to lower pension contributions? Since PBO incorporates employees' future compensation level, it is usually greater than ABO (Kwan, 2003). There have been discussions about which pension liability estimate, ABO or PBO, is a better measure of pension fund obligation (Bodie, 1999; Salva and Beik, 2003; Sohn 2006). Studying the differences and consequences of the two reporting requirements should be an interesting research project but it is out of the scope of this study.

Figure 2 shows MC, DRC and NewLia as proportions of fund current assets by years. The overall trends demonstrate a positive association between DRC, MC and NewLia. DRC values jumped after 1994 due to the change in the calculation of DRC corresponding RPA '94 which became law on December 8, 1994[5]. Furthermore, more conservative assumptions were used for determining liability, resulting in higher current liability values. In keeping with the stock market, the three variable values also become more volatile after 2000.

Correlations between MC characteristics and TA, FV and PBO are presented in

[5] Starting 1995, in addition to NewLia and OldLia, the DRC includes the expected increase in the RPA'94 current liability due to benefits accruing during the plan year and the aggregate of the unfunded mortality increase amounts.

Figure 2. The Proportions of Mandatory Contribution, Deficit Reduction Contribution and Fund New Liability Amount to Fund Current Asset (MCToCur, DrcToCur and MewLToCur).

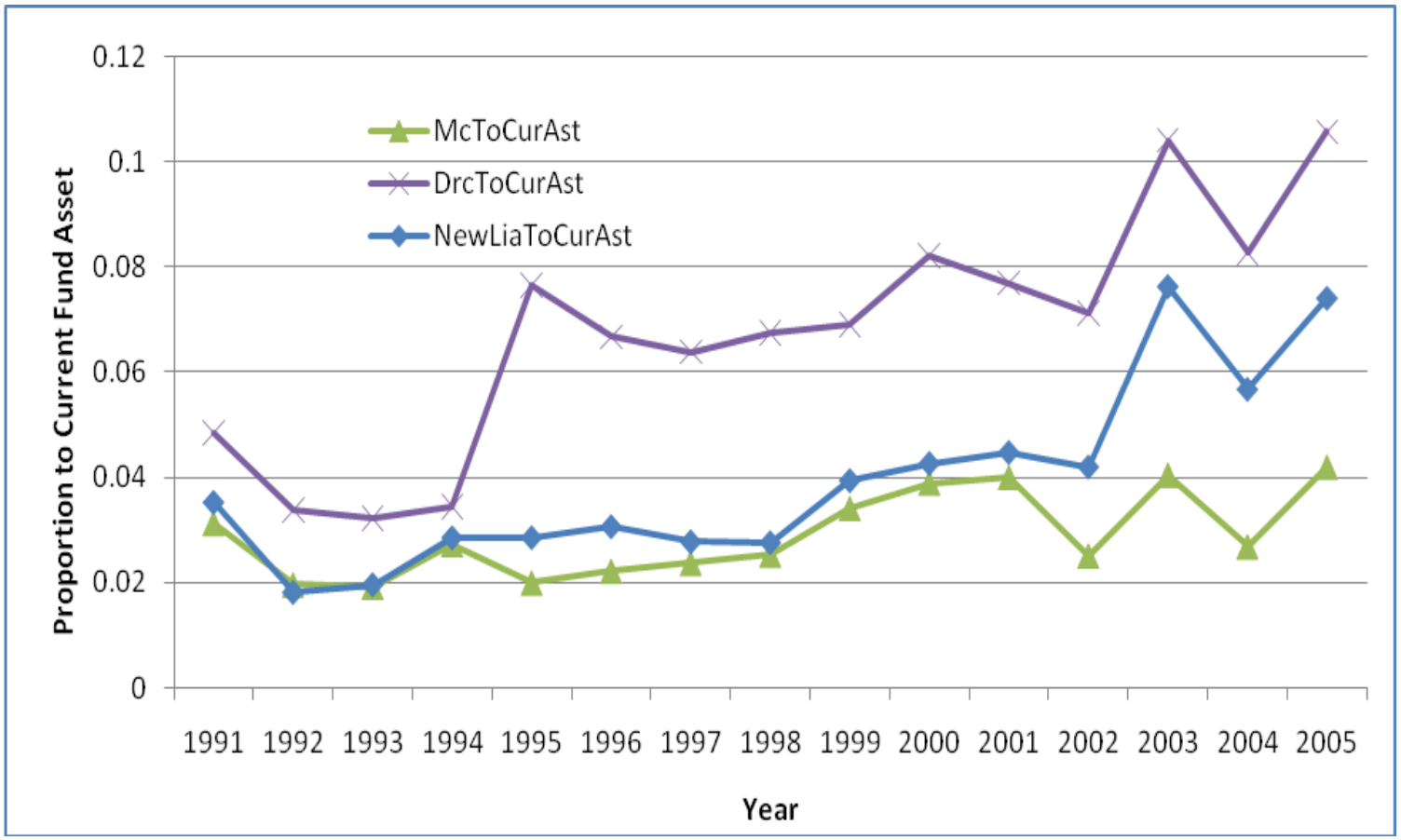


Table 8. The Pearson correlations are shown above the diagonals. MC is highly correlated with DRC and NewLia. MRC is highly correlated with NewLia and MC due to the contribution of the latter two in determining MRC. CurAst and CurLia are highly correlated (.96) and DRC is highly correlated with NewLia(.75). All three variables from Compustat, TA, FV and PBO are highly correlated with one another. Since CurAst and CurLia account for high proportions of FV and PBO, they are all highly correlated.

Table 9 reports earnings-to-price (E/P), and book-to-market (BE/ME) ratios, as well as monthly returns, and monthly value and equally-weighted weighted returns for NMC and MC firms. The E/P ratios show that the NMC firms earn 3.5 cent yearly for each dollar of stock price, while MC firms earn negative 0.3 cent yearly for each dollar of stock prince. The higher earnings from NMC firms don't necessarily imply these firms are value firms in comparison with MC firms because the BE/ME for NMC firms is only 1% higher than the corresponding value for MC firms. All three returns show that the NMC firms earn higher monthly returns than the MC firms.

Table 8. Correlations between MC Firm Characteristics.

Pearson correlations coefficients are above the diagonal and the Spearman correlation coefficients are below the diagonal.

Name	MC	DRC	MRC	OldLia	NewLia	CurAst	CurLia	TA	FV	PBO
MC		0.90	0.82	0.22	0.45	0.21	0.24	0.13	0.24	0.27
DRC	0.87		0.69	0.43	0.75	0.21	0.30	0.14	0.26	0.34
MRC	0.62	0.61		0.17	0.69	0.13	0.19	0.07	0.09	0.20
OldLia	0.09	0.23	-0.08		0.43	0.11	0.21	0.13	0.17	0.24
NewLia	0.76	0.83	0.60	-0.05		0.20	0.31	0.16	0.25	0.34
CurAst	0.55	0.58	0.30	0.13	0.47		0.96	0.68	0.96	0.91
CurLia	0.59	0.63	0.36	0.15	0.52	0.99		0.62	0.94	0.93
TA	0.46	0.45	0.11	-0.03	0.40	0.71	0.71		0.68	0.66
FV	0.50	0.51	0.20	0.10	0.42	0.92	0.91	0.84		0.98
PBO	0.54	0.55	0.23	0.10	0.46	0.91	0.91	0.85	0.99	

Table 9. Earnings to Price (E/P), Book Equity to Market Equity (BE/ME), Monthly Returns (Ret) and Value-Weighted (VWRET) and Equally-Weighted (EWRET) Returns for NMC and MC Firms.

	E/P	BE/ME	Ret	VWRET	EWRET
NMC	0.0348	0.6631	0.0131	0.0081	0.0145
MC	-0.0030	0.6524	0.0090	0.0063	0.0119

CHAPTER 5

FIRMS WITH CONSECUTIVE MANDATORY CONTRIBUTION YEARS

Table 4 shows that 785 of the 1,218 MC firms have only one MC period with length ranging from 1 to 15 years. Firms with fewer MC years are likely to be less adversely affected by the MC requirement, their quicker recovery also suggesting enough financial strength to reduce the gap between pension asset and liability. On the other hand, firms with extended MC years are likely to have greater financial difficulty in meeting their pension obligations and to be more adversely impacted by the MC requirement. To examine how firms are affected by the MC string length, I classify the 785 firms with one continuous MC period into six groups, MCX, with X ranging from 1 to 6 to indicate the length of the period (e.g., MC5 indicates five consecutive years, MC6 indicates six or more consecutive years).

5.1 Excess Returns across MCX Groups

Panel A of Table 10 presents descriptive statistics for the six MC groups described above. Panel A shows statistics using Compustat data. Generally, firms with shorter MC period length perform better than those with more consecutive MC years, with firms that make six or more years of MC consecutively (MC6) performing the worst. The pension assets of MC1 and MC2 firms meet 96% of PBO: 6-8% higher than MC3 and MC4 firms and 9-12% higher than MC5 and MC6 firms. MC1 and MC2 firms report higher OCF, ROA, ROE, CapExp, and lower LTD and PenCost than the other four MC firms. The yearly unadjusted returns of MC1 to MC6 are 0.055, 0.064, 0.050, 0.026, 0.083 and 0.017 respectively. Although MC5 firms show the highest yearly unadjusted return, the ROA of those firms is lower than that of MC1 to MC4 firms, and the ROE of MC5 firms is lower than that of MC1 and MC2 firms.

Table 10. Descriptive Statistics for Six Mandatory Contribution (MC) Groups.

MC6 consists of firms with six or more consecutive MC years. MC1, MC2, MC3, MC4 and MC5 consist of firms with one, two, three, four or five consecutive MC years, respectively. TA, MktCap, FV and PBO are in millions of dollars and all other variables are expressed in ratios. See Table 2 for variable definitions.

Panel A. Descriptive Statistics of Six Mandated Contribution (MC) Groups Calculated from Compustat.

	MC 1		MC 2		MC 3		MC 4		MC 5		MC 6	
Var	mean	median	mean	median	mean	median	mean	median	mean	median	mean	median
TA	5923.7	1087.7	3967.8	871.1	4761.0	572.0	3780.2	804.5	3587.6	616.4	3342.7	556.2
MktCap	3367.1	709.0	3157.2	712.0	1918.7	537.1	4594.9	629.3	2373.8	552.2	2495.0	276.0
NOA	0.6141	0.6620	0.6051	0.6404	0.7217	0.7256	0.6596	0.6832	0.6518	0.6508	0.6323	0.6463
TotAccru	-0.0533	-0.0489	-0.0552	-0.0520	-0.0585	-0.0540	-0.0372	-0.0427	-0.0555	-0.0509	-0.0504	-0.0450
NI	0.0401	0.0373	0.0426	0.0412	0.0349	0.0372	0.0403	0.0428	0.0345	0.0383	0.0177	0.0302
OCF	0.0966	0.0941	0.0989	0.0927	0.0909	0.0931	0.0826	0.0844	0.0896	0.0849	0.0732	0.0716
RD	0.0346	0.0203	0.0285	0.0187	0.0279	0.0205	0.0266	0.0204	0.0410	0.0284	0.0264	0.0187
CapExp	0.0605	0.0501	0.0615	0.0522	0.0603	0.0461	0.0551	0.0489	0.0533	0.0474	0.0498	0.0424
Acquisition	0.0200	0.0000	0.0234	0.0000	0.0198	0.0000	0.0210	0.0000	0.0220	0.0000	0.0180	0.0000
Dividend	0.5170	0.3232	0.4401	0.2000	0.4089	0.1600	0.4864	0.2400	0.4356	0.0000	0.4033	0.0800
LTD	0.2222	0.1918	0.2334	0.2111	0.2448	0.2222	0.2558	0.2069	0.3013	0.2819	0.3031	0.2789
LTDissue	0.0893	0.0289	0.0943	0.0410	0.0789	0.0176	0.0849	0.0289	0.1195	0.0366	0.1182	0.0472
FV	458.5	75.4	526.6	83.3	403.2	35.0	581.7	58.5	553.6	67.3	469.7	63.0
PBO	469.8	79.3	515.7	94.3	421.2	40.2	706.4	72.8	650.7	77.6	502.2	72.9
FvToTa	0.1424	0.0958	0.1654	0.1143	0.1131	0.0858	0.1600	0.1184	0.1454	0.0846	0.1617	0.1336
PboToTa	0.1437	0.0997	0.1628	0.1097	0.1246	0.0913	0.1634	0.1380	0.1522	0.1081	0.1837	0.1536
FvToPbo	0.9685	0.9665	0.9611	0.9290	0.8817	0.8838	0.8958	0.9039	0.8389	0.8310	0.8705	0.8522
FR	-0.0308	-0.0016	-0.0211	-0.0035	-0.0251	-0.0077	-0.0967	-0.0061	-0.0726	-0.0137	-0.1491	-0.0162
Fstatus	-0.0010	-0.0011	0.0003	-0.0030	-0.0105	-0.0062	-0.0047	-0.0067	-0.0121	-0.0085	-0.0156	-0.0152
OBSliab	-0.0015	0.0004	0.0031	0.0038	0.0064	0.0032	0.0053	0.0054	0.0092	0.0102	0.0033	0.0039
CompRate	4.7409	4.7500	4.8028	5.0000	4.7142	5.0000	4.7039	4.5000	4.5133	4.6000	4.8455	5.0000
DiscRate	7.3840	7.5000	7.4957	7.5000	7.3982	7.5000	7.4090	7.5000	7.5369	7.5000	7.4630	7.5000
IntCost	0.0103	0.0070	0.0114	0.0079	0.0085	0.0065	0.0117	0.0099	0.0107	0.0073	0.0131	0.0108
PenCost	0.0031	0.0021	0.0032	0.0026	0.0040	0.0029	0.0037	0.0034	0.0040	0.0031	0.0047	0.0042
ServCost	0.0047	0.0038	0.0046	0.0038	0.0040	0.0033	0.0049	0.0045	0.0048	0.0037	0.0052	0.0046
OthPCost	0.0026	0.0004	0.0027	0.0007	0.0022	0.0009	0.0036	0.0010	0.0024	0.0004	0.0033	0.0015
PriorSC	0.0039	0.0016	0.0037	0.0013	0.0028	0.0008	0.0041	0.0025	0.0031	0.0031	0.0059	0.0042
ERR	8.8560	9.0000	8.9722	9.0000	8.8052	9.0000	8.7570	8.6000	9.1469	9.0000	8.9412	9.0000
RET	0.0547	0.0241	0.0643	0.0239	0.0501	0.0417	0.0259	0.0186	0.0828	0.0350	0.0169	0.0040
ROA	0.0090	0.0088	0.0097	0.0099	0.0075	0.0089	0.0088	0.0107	0.0073	0.0090	0.0035	0.0072
ROE	0.0284	0.0310	0.0318	0.0337	0.0178	0.0247	0.0120	0.0263	0.0217	0.0275	0.0260	0.0272
Range	725 - 2306		276 – 898		145 – 494		191 – 428		96 – 241		278 - 694	

Panel B. Descriptive Statistics of Six Mandated Contribution (MC) Groups Calculated from Form 5500 Schedule B Data.

	MC 1		MC 2		MC 3		MC 4		MC 5		MC 6	
Vartable	mean	median	mean	median	mean	median	mean	median	mean	median	mean	median
GWAY	0.7803	0.6407	0.7495	0.6190	0.6823	0.5738	0.6958	0.6204	0.6446	0.5201	0.6042	0.4975
McToCurAst	0.0033	0.0000	0.0071	0.0000	0.0127	0.0000	0.0130	0.0000	0.0198	0.0003	0.0231	0.0062
DrcToCurAst	0.0128	0.0000	0.0231	0.0000	0.0361	0.0000	0.0374	0.0000	0.0603	0.0068	0.0767	0.0326
OldLiaToCurAst	0.0006	0.0000	0.0014	0.0000	0.0018	0.0000	0.0039	0.0000	0.0060	0.0000	0.0151	0.0012
NewLiaToCurAst	0.0054	0.0000	0.0126	0.0000	0.0175	0.0000	0.0211	0.0000	0.0422	0.0000	0.0426	0.0146
Range	2563 - 2784		1016 - 1122		637 - 711		529 - 626		270 - 334		733 - 916	

Panel B of Table 10 displays statistics for the 6 firm groups using Schedule B data. There is clearly a trend indicating that the ratios of MC, DRC, old liability and new liability to current fund asset value are increasing from MC1 to MC6, with MC1 values being the smallest and MC6 the largest. On the other hand, the Gateway percentages decrease from MC1 firms to MC6 firms, with the MC1 being the largest and the MC6 the smallest.

Table 11 reports regression results from market, three-factors and four-factors models. Although there are differences in signs, magnitudes and statistical significance, the overall intercepts show that MC1 firms earn higher equally weighted returns than MC6 firms. The pattern of returns is unclear for value-weighted returns. The estimated market betas for MC4, MC5 and MC6 are larger (lower) than the estimated market betas for MC1, MC2 and MC3 in all three models for the equally (value) weighted returns. This indicates that firms that make more consecutive mandated contributions are more (less) associated with the market performance in terms of equal (value) weighted returns. The coefficients of SMB and HML of equal weighted returns for MC6 are larger than those in the other groups in either three-factor model or four-factor model, indicating that the size effect and value effects are larger for MC6 firms.

Adjusted returns for Market beta, three-factors and four-factors are shown in Table 12. Both value and equally weighted adjusted returns of MC1 and MC2 firms are significantly positive for all three model equations. On the other hand, the adjusted returns for MC6 firms from three-factor and four-factor models are significant negative. Why does the market appear to reward firms that make one or two years of MC? Perhaps the market expects the MC to continue for a longer time, and is positively surprised when these firms stop making MC. Why is the market surprised at the firms that make more than 5 years of MC? Underfunded firms are required to amortize the shortfall of pension obligation within 3-5 years. It is reasonable to assume that the market expects these firms to cover the deficit in 5 years and is negatively surprised by a longer MC period.

Table 11. Regression Coefficients and Adjusted R Squares of Market Model, Three-Factor Model and Four-Factor Model for Six Mandated Contribution Groups.

The MC groups are defined as in Table 10.

	VWRET						EWRET					
	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6
Market Model												
Intercept	0.0004	0.0023	0.0011	0.0038	0.0054	0.0034	0.0046	0.0056	0.0038	0.0043	0.0065	0.0007
	(0.261)	(1.042)	(0.509)	(1.953)	(2.536)	(1.365)	(3.088)	(3.504)	(1.720)	(1.878)	(2.504)	(0.297)
Market	0.9941	0.7452	0.7542	0.7389	0.6507	0.6588	0.8400	0.7789	0.6995	0.9028	0.9734	0.8628
	(27.047)	(13.785)	(14.655)	(15.274)	(12.383)	(10.630)	(23.099)	(19.938)	(13.014)	(16.157)	(15.350)	(14.977)
Adj R^2	0.7629	0.4544	0.4850	0.5058	0.4016	0.3304	0.7011	0.6359	0.4258	0.5339	0.5083	0.4959
Three-Factor Model												
Intercept	0.0009	0.0003	-0.0038	0.0017	0.0030	0.0013	0.0008	0.0022	-0.0011	0.0004	0.0038	-0.0049
	(0.628)	(0.124)	(-2.285)	(0.955)	(1.416)	(0.548)	(0.743)	(1.679)	(-0.634)	(0.225)	(1.585)	(-2.773)
Market	1.0101	0.9026	1.0297	0.9072	0.7757	0.8306	0.9983	0.9139	0.8941	1.0348	1.0353	1.0840
	(25.536)	(15.737)	(22.378)	(18.490)	(13.380)	(12.600)	(33.907)	(26.093)	(18.837)	(19.182)	(15.689)	(22.558)
smb	-0.2477	-0.1866	0.0996	-0.2119	0.1078	-0.2340	0.3573	0.3693	0.5110	0.5127	0.5068	0.5928
	(-5.716)	(-2.969)	(1.975)	(-3.942)	(1.698)	(-3.240)	(11.078)	(9.626)	(9.828)	(8.675)	(7.010)	(11.261)
hml	-0.0686	0.3165	0.7419	0.3329	0.3640	0.3320	0.5585	0.5047	0.7182	0.5604	0.3804	0.8215
	(-1.276)	(4.062)	(11.868)	(4.994)	(4.622)	(3.707)	(13.963)	(10.608)	(11.138)	(7.647)	(4.243)	(12.584)
Adj R^2	0.7922	0.5351	0.6884	0.6153	0.4489	0.4267	0.8518	0.7786	0.6612	0.6712	0.5970	0.7346
Four-Factor Model												
Intercept	0.0031	-0.0007	-0.0035	0.0012	0.0030	0.0019	0.0026	0.0032	0.0005	0.0030	0.0066	-0.0028
	(2.313)	(-0.305)	(-2.041)	(0.666)	(1.372)	(0.783)	(2.614)	(2.456)	(0.284)	(1.564)	(2.815)	(-1.616)
Market	0.9485	0.9282	1.0210	0.9207	0.7758	0.8134	0.9488	0.8857	0.8497	0.9644	0.9572	1.0249
	(25.702)	(15.804)	(21.538)	(18.244)	(12.972)	(11.991)	(35.194)	(25.132)	(17.953)	(18.556)	(14.863)	(21.958)
smb	-0.2223	-0.1971	0.1031	-0.2174	0.1078	-0.2269	0.3777	0.3809	0.5293	0.5417	0.5389	0.6171
	(-5.637)	(-3.140)	(2.036)	(-4.031)	(1.686)	(-3.130)	(13.107)	(10.114)	(10.464)	(9.752)	(7.829)	(12.371)
hml	-0.1140	0.3353	0.7355	0.3429	0.3641	0.3193	0.5220	0.4840	0.6855	0.5085	0.3229	0.7779
	(-2.320)	(4.289)	(11.654)	(5.103)	(4.573)	(3.536)	(14.543)	(10.315)	(10.879)	(7.350)	(3.766)	(12.520)
umd	-0.2015	0.0835	-0.0284	0.0443	0.0005	-0.0565	-0.1618	-0.0922	-0.1452	-0.2303	-0.2552	-0.1932
	(-7.048)	(1.835)	(-0.774)	(1.133)	(0.010)	(-1.075)	(-7.749)	(-3.378)	(-3.961)	(-5.721)	(-5.116)	(-5.343)
Adj R^2	0.8293	0.5400	0.6879	0.6158	0.4464	0.4271	0.8827	0.7884	0.6821	0.7120	0.6377	0.7637

Table 12. Value-Weighted and Equally-Weighted Returns Adjusted by Market, Three-Factors and Four-Factors for Six Mandated Contribution (MC) Groups.

The MC groups are defined as in Table 10.

	VWRET						EWRET					
	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6
						Market Adjusted Returns						
MEAN	0.0034	0.0060	0.0046	0.0028	0.0067	0.0004	0.0044	0.0058	0.0049	0.0018	0.0046	-0.0011
	(6.924)	(7.766)	(4.181)	(2.100)	(3.625)	(0.365)	(9.061)	(7.460)	(4.482)	(1.349)	(2.492)	(-0.998)
MEDIAN	0.0012	0.0041	0.0021	0.0006	0.0028	0.0011	0.0021	0.0039	0.0023	-0.0003	-0.0001	-0.0004
						Three-Factor Adjusted Returns						
MEAN	0.0038	0.0042	-0.0007	0.0004	0.0045	-0.0018	0.0010	0.0028	-0.0001	-0.0017	0.0024	-0.0059
	(7.634)	(5.389)	(-0.613)	(0.325)	(2.463)	(-1.578)	(2.007)	(3.605)	(-0.109)	(-1.254)	(1.332)	(-5.208)
MEDIAN	0.0017	0.0022	-0.0028	-0.0013	-0.0008	-0.0012	-0.0013	0.0011	-0.0019	-0.0035	-0.0028	-0.0061
						Four-Factor Adjusted Returns						
MEAN	0.0061	0.0033	-0.0004	0.0001	0.0045	-0.0012	0.0028	0.0038	0.0014	0.0009	0.0054	-0.0037
	(12.415)	(4.190)	(-0.332)	(0.074)	(2.460)	(-1.031)	(5.904)	(4.902)	(1.323)	(0.697)	(2.998)	(-3.277)
MEDIAN	0.0038	0.0013	-0.0023	-0.0018	-0.0008	-0.0006	0.0006	0.0023	-0.0003	-0.0011	0.0014	-0.0039

5.2 Analyst Earnings Forecasts, Forecast Errors and Revisions across MCX Groups

In this section I examine analyst forecasts and revisions across different MCX groups as defined in previous sub-section. The questions investigated are how and when analysts take mandatory contribution into consideration and whether they distinguish between different MCX groups. If analysts don't take the implications of MC requirements into consideration when making the initial forecast, they will forecast higher earnings for MC firms, resulting in greater forecast errors. If analysts subsequently incorporate MC-related information into forecasts, they should make revisions to their initial forecast, resulting in reduced forecast error.

Table 13 reports analyst forecast data after the first MC occurrence for the 6 MC groups. I omitted the median forecasts from the table because they are very similar to the mean forecasts in magnitude and trend and show similar results. Panel A shows the first quarter earnings forecast after the first MC occurrence. Mean forecasts for the 6 MC groups are all positive, ranging from 0.23 to 0.36. But the mean forecast for MC6 firms is the largest and that of MC5 is the second largest, indicating analysts don't anticipate these firms will be more financially constrained than other firms. All mean forecast errors (FE) are positive (although not statistically significant), with the MC6 group showing the largest FE value. The mean of absolute forecast errors (AbsFE) reveals that analyst forecast MC5 and MC6 firms less accurately than other MC firms. Panel B reports the averaged quarterly forecasts from quarter two to quarter four after first MC occurred. Analyst forecasts for MC5 and MC6 firms are still higher than for other MC firms, with FE and AbsFE of MC6 showing less forecast accuracy for this group than for other MC firms. Panel C reports the averaged quarterly forecasts for the third year after the first MC occurrence. In contrast with the data in Panel A and B in which analyst forecast mean is highest for MC6 firms, analysts now appear to recognize these heavily underfunded MC firms and project lower earnings for this group than for other MC firms. The overall smaller AbsFE values

Table 13. Analyst Quarterly Earnings Forecasts after First MC Occurrence for the Six Mandated Contribution (MC) Groups.

The MC groups are defined in Table 10. Forecast is the average of the forecasted quarterly earnings; FE is the forecasted earnings mean minus actual earnings per share scaled by the price of the previous month multiplied by 100; AbsFE is the absolute value of FE. All numbers are means with t values in parentheses.

	MC1	MC2	MC3	MC4	MC5	MC6
Panel A. Quarterly Earnings Forecast for First Quarter after the First MC Occurrence						
Forecast	**0.28**	**0.26**	**0.29**	**0.23**	**0.35**	**0.36**
	(12.86)	(7.19)	(5.23)	(6.49)	(6.72)	(6.78)
FE	**0.02**	**0.11**	**0.05**	**0.01**	**0.09**	**0.21**
	(0.21)	(1.04)	(0.50)	(0.09)	(0.51)	(0.89)
AbsFE	**0.40**	**0.42**	**0.33**	**0.29**	**0.52**	**0.66**
	(4.96)	(4.73)	(3.73)	(4.23)	(3.87)	(3.26)
Panel B. Quarterly Earnings Forecast from Second through Fourth Quarter after the First MC Occurrence						
Mean	**0.32**	**0.31**	**0.30**	**0.23**	**0.35**	**0.35**
	(22.59)	(14.83)	(11.46)	(7.06)	(8.37)	(9.60)
FE	**0.00**	**-0.06**	**-0.02**	**0.13**	**0.12**	**0.65**
	(0.03)	(-0.27)	(-0.10)	(0.80)	(0.86)	(2.39)
AbsFE	**0.39**	**0.57**	**0.47**	**0.58**	**0.38**	**0.79**
	(6.13)	(2.90)	(3.29)	(3.99)	(2.60)	(2.96)
Panel C. Quarterly Earnings Forecast for the Third Year after the First MC Occurrence						
Mean	**0.33**	**0.38**	**0.35**	**0.37**	**0.35**	**0.33**
	(26.43)	(17.73)	(9.54)	(10.70)	(7.57)	(11.73)
FE	**-0.03**	**-0.03**	**-0.05**	**-0.05**	**-0.05**	**0.02**
	(-1.42)	(-0.92)	(-0.74)	(-0.55)	(-1.07)	(0.27)
AbsFE	**0.20**	**0.18**	**0.31**	**0.29**	**0.24**	**0.22**
	(10.97)	(6.78)	(5.62)	(3.41)	(6.25)	(3.87)
Panel D. Quarterly Earnings Forecast for the Fifth Year after the First MC Occurrence						
Mean	**0.37**	**0.39**	**0.40**	**0.34**	**0.43**	**0.41**
	(23.87)	(15.56)	(8.73)	(10.22)	(8.72)	(11.07)
FE	**-0.03**	**-0.06**	**-0.04**	**-0.06**	**-0.05**	**0.04**
	(-1.66)	(-1.89)	(-1.34)	(1.85)	(-0.93)	(0.90)
AbsFE	**0.16**	**0.17**	**0.12**	**0.16**	**0.18**	**0.24**
	(11.49)	(6.95)	(5.61)	(5.39)	(4.27)	(5.77)

compared to that in Panel A and Panel B indicate that analyst forecasts improve two years after the firm's first MC occurrence. Panel D reports the averaged quarterly forecasts for the fifth year after the first MC. The AbsFE shows that the analysts continue improving forecast accuracy in the fifth year for the MC1 to MC5 firms but still have difficulty making forecasts for MC6 firms. FE is marginally significant negative for MC1 and MC2 and MC4 firms showing that analysts tend to underestimate these MC firms after they stop being subject to the MC requirement. The overall results show that analysts don't immediately recognize the implications of MC and therefore overestimate forecasts initially. They incorporate the MC information into forecasts two years after the first MC occurrence, perhaps when MC-related information in DOL filings becomes more easily accessible. The deadline set by EBSA for filing the annual 5500 report is the last day of the seventh month after the close of the plan year. Also, a plan can request a two-and-one-half month extension by filing a Form 5558 before the due date. EBSA starts compiling, processing and examining the filings after receiving the reported forms. Partial data will be available one year after the close of the plan year, but the complete set of data is not easily available until the end of the second year[6].

Table 14 presents analyst quarterly revisions for different period after the first MC occurrence. Panel A shows the first quarter revisions. The number of revisions in MC3 firms is the highest and in MC6 firms is the lowest. However, in terms of mean analyst following, MC1 (MC6) firms have the highest (lowest) following. NRev% that measures the revision frequency per analyst shows that analysts tend to revise forecast more frequently for MC3, MC4 and MC5 firms. Mean revisions (Rev) are all negative, showing that analysts overestimate these firms initially and adjust their forecast downwards when the additional information become available. The larger Rev values for MC4 and MC6

[6] Personal communication with the EBSA data specialist confirms that the time to release the complete data is about two years after the close of the plan year.

Table 14. Analyst Quarterly Revisions for the Six MC Groups.

The MC groups are defined in Table 10. NRev is the number of quarterly revisions by analysts. Followings is the number of analysts who made at least one forecast for the quarter. NRev% is the ratio of NRev to Followings. Rev is calculated by subtracting the previous forecast from the new forecast and then dividing the difference by the price of the previous month. AbsRev is the absolute values of revisions. NegRev% is the proportion of analysts who made negative revisions. PosRev% is the proportion of analysts who made positive revisions. All numbers are means with t values in parentheses.

	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6
Panel A. First Quarter Revisions after First MC						
NRev	2.72	2.56	3.29	3.18	2.42	1.84
	(10.93)	(6.73)	(3.76)	(5.75)	(8.40)	(7.52)
Followings	6.98	6.66	5.79	6.00	5.33	5.21
	(15.77)	(9.17)	(6.89)	(8.56)	(6.74)	(5.71)
NRev %	0.44	0.45	0.63	0.60	0.58	0.43
	(14.96)	(8.43)	(4.63)	(5.11)	(6.26)	(7.19)
Rev	-0.12	-0.12	-0.16	-0.46	-0.17	-0.37
	(-2.72)	(-1.71)	(-2.23)	(-2.62)	(-1.39)	(-2.83)
AbsRev	0.25	0.30	0.30	0.31	0.31	0.32
	(7.19)	(21.07)	(16.28)	(12.11)	(14.47)	(14.86)
NegRev %	61.22	54.88	56.19	77.14	55.17	68.57
PosRev %	37.72	45.12	28.26	22.86	44.83	31.43
Panel B. Second to Fourth Quarter Revisions after First MC						
NRev	3.22	3.03	2.91	2.61	2.48	2.38
	(17.27)	(11.95)	(7.53)	(5.88)	(7.37)	(8.59)
Followings	7.35	6.44	6.17	5.52	5.45	5.85
	(25.60)	(15.33)	(11.21)	(10.24)	(9.48)	(10.80)
NRev %	0.51	0.59	0.60	0.52	0.53	0.50
	(23.43)	(14.70)	(9.35)	(7.61)	(10.41)	(11.59)
Rev	-0.04	-0.11	-0.12	-0.02	-0.14	-0.12
	(-1.91)	(-3.03)	(-2.58)	(-0.32)	(-2.52)	(-2.94)
AbsRev	0.22	0.30	0.30	0.31	0.31	0.32
	(13.27)	(21.07)	(16.28)	(12.11)	(14.47)	(14.86)
NegRev %	41.89	52.54	58.43	51.85	49.35	75.40
PosRev %	46.55	41.74	39.55	48.15	50.65	24.60

Table 14. (Continued)

Panel C. Third Year Revisions after First MC						
NRev	3.50	2.90	3.07	2.69	3.13	3.21
	(20.02)	(11.58)	(8.48)	(8.64)	(9.64)	(9.10)
Followings	8.25	7.32	7.36	7.33	7.46	7.31
	(30.53)	(18.20)	(16.88)	(13.13)	(13.77)	(12.47)
NRev %	0.48	0.51	0.44	0.40	0.47	0.53
	(24.47)	(13.43)	(10.18)	(11.10)	(10.88)	(11.35)
Rev	-0.10	-0.12	-0.08	0.01	-0.11	-0.10
	(-5.02)	(-3.00)	(-1.87)	0.42	(-1.91)	(-2.13)
AbsRev	0.21	0.30	0.30	0.31	0.31	0.32
	(12.39)	(21.07)	(16.28)	(12.11)	(14.47)	(14.86)
NegRev %	58.04	65.28	64.53	50.44	45.33	65.24
PosRev %	35.89	29.88	35.47	49.56	54.67	35.22
Panel D. Fifth Year Revisions after First MC						
NRev	3.11	2.81	2.13	3.22	3.50	2.24
	(16.17)	(9.24)	(10.72)	(7.11)	(7.75)	(8.00)
Followings	8.95	7.12	5.67	6.34	6.87	7.02
	(22.83)	(12.47)	(9.40)	(10.51)	(10.18)	(11.69)
NRev %	0.44	0.46	0.43	0.56	0.53	0.45
	(19.98)	(12.01)	(13.92)	(8.51)	(9.89)	(8.76)
Rev	-0.08	-0.13	-0.04	-0.02	-0.01	-0.12
	(-4.81)	(-2.80)	(-1.04)	(-0.38)	(-0.29)	(-2.48)
AbsRev	0.17	0.30	0.30	0.31	0.31	0.32
	(10.46)	(21.07)	(16.28)	(12.11)	(14.47)	(14.86)
NegRev %	58.53	51.36	61.45	47.10	53.33	72.81
PosRev %	37.16	47.04	38.55	36.08	46.67	29.54

firms further suggest that analysts fail to differentiate between these MC firms and other MC firms when forecasting and make the larger revision for these groups when receiving the new information. The absolute revision (AbsRev) shows that analysts make smaller revisions for MC1 firms and the information based on which they make forecasts for this group of firms is more accurate than for other MC firms. Proportions of negative revisions are higher than positive revisions, consistent with the finding that analyst forecasts are generally overestimated.

Panel B shows the average revisions from second quarter to fourth quarter after the first MC occurrence. The results show that analyst revisions get smaller for all MC firm groups. However, AbsRev values are similar to those for the first quarter, except for a three-cent improvement for MC1 firms. The initial forecasts are still overestimated as shown by the negative Rev. The percentage of the negative revision (NegRev%) for MC6 firms is 33.5% higher than for MC1 firms, indicating that MC6 firms are more difficult to forecast.

Panel C shows the average quarterly revisions in the third year after the first MC occurrence. The number of revisions by per analyst (NRev%) shows that analysts now revise more frequently than in the first quarter or the second to fourth quarter, possibly due to greater availability of MC-related information. Within the six MC groups, NRev% is highest for MC6 firms, and their forecasts are still generally overestimated. The magnitude of revisions is smallest for MC1 firms as shown by AbsRev.

Panel D shows that five years after the first MC occurrence, analysts make the smallest revisions for MC1 firms and the largest revisions for MC6 firms. The second line from the bottom of the table reveals that 73% of analyst revisions for MC6 firms are negative, 10% to 26% more than for the other five MC firm groups. This result, together with less frequent revisions than in year three, large negative revisions and largest absolute value revisions, indicate that although analysts utilize the available MC information in

forecasts and revisions, they have difficulty in forecasting MC6 firms correctly, perhaps due to the continuing MC requirement for these firms after five consecutive years of MC.

The overall results from analyst forecasts and revisions suggest that analysts don't recognize the implications of MC immediately but gradually incorporate this information into their forecasts. They seem to distinguish between the two extreme groups, MC1 and MC6 firms, and make the smallest and largest revisions accordingly, although they have difficulty distinguishing between the groups in between.

Figure 3 and Figure 4 depict analysts' quarterly forecast errors 24 quarters after the first MC for the 6 MC groups. Forecasts errors for the MC1 to MC3 groups are reduced one year after the firms' first MC occurrence. There is also a shift towards predominantly negative FE. The smaller FEs for the MC1 group show that analysts forecast those firms more accurately than MC2and MC3 firms. In contrast, the forecast errors are much larger and more volatile for MC4, MC5 and MC6 firms over the whole period as shown in figure 4.

Figures 5 and Figure 6 depict analysts' quarterly revisions 24 quarters after the first MC occurrence for the six MC groups. The two figures show that most revisions are downwards, confirming that analysts overestimate initially and revise their forecasts downwards when additional information is available. In comparison with revisions for MC1 to MC3 firms shown in Figure 5, Figure 6 indicates that revisions for MC4 to MC6 firms are larger in magnitude and more volatile. Overall, quarterly forecast errors and revisions show that analyst forecasts become less accurate and more volatile as firms make more consecutive years of MC.

5.3 Institutional Investor Holdings across MCX Groups

Institutional investors are financially sophisticated. Because they hold large

Figure 3. Analyst Quarterly Forecast Errors (FE) for MC1, MC2 and MC3 Firms from Quarter 0 to Quarter 24 afer the First MC.

Forecast error is calculated as indicated by equation (4).

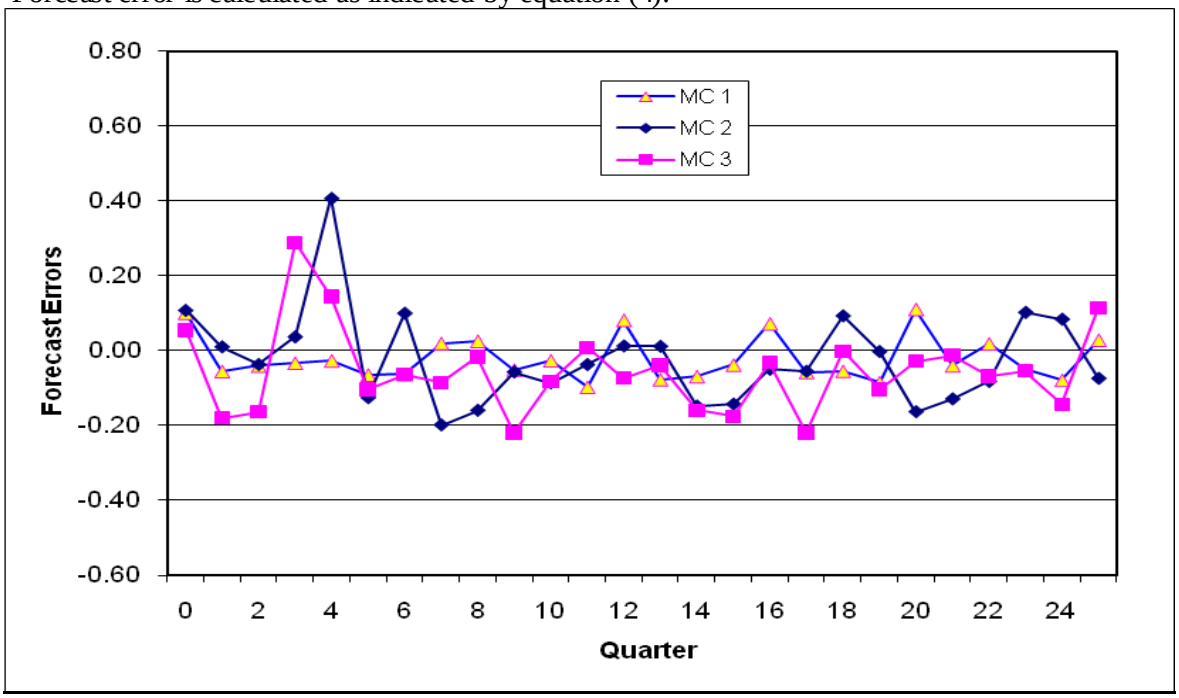


Figure 4. Analyst Quarterly Forecast Errors (FE) for MC4, MC5and MC6 Firms from Quarter 0 to Quarter 24 after the First MC.

Forecast error is calculated as indicated by equation (4).

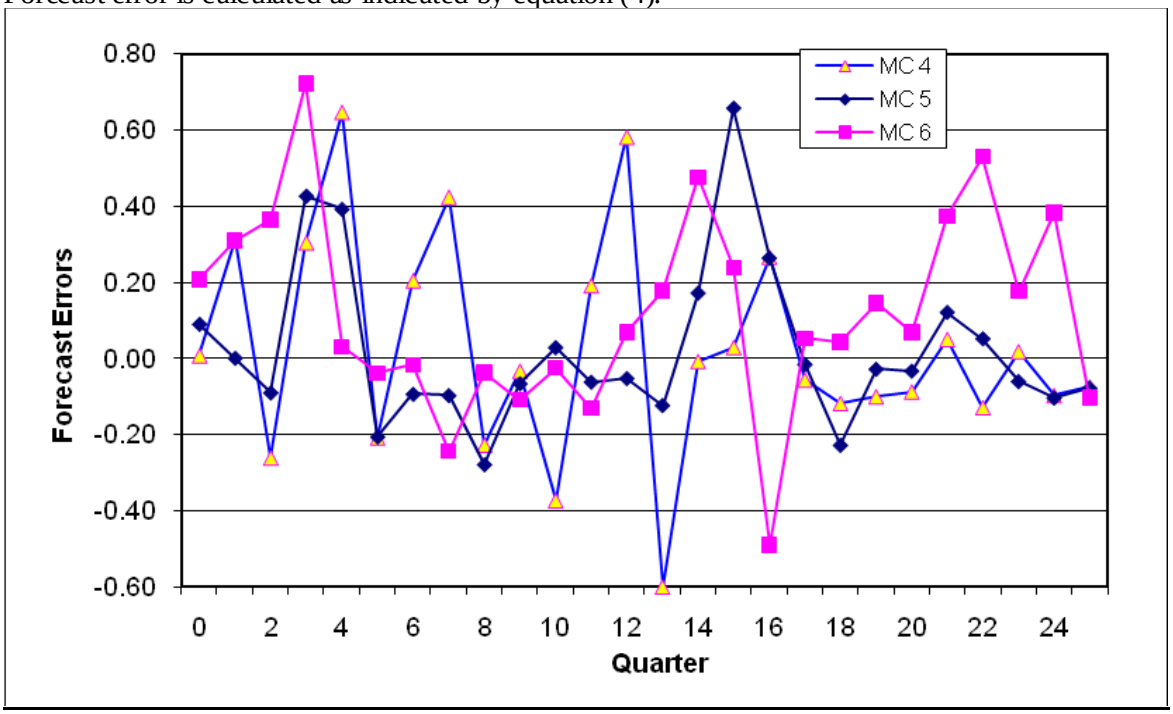


Figure 5. Analyst Quarterly Revisions for MC1, MC2 and MC3 Firms from Quarter 0 to Quarter 24 after the First MC.

Revision is calculated by equation (6).

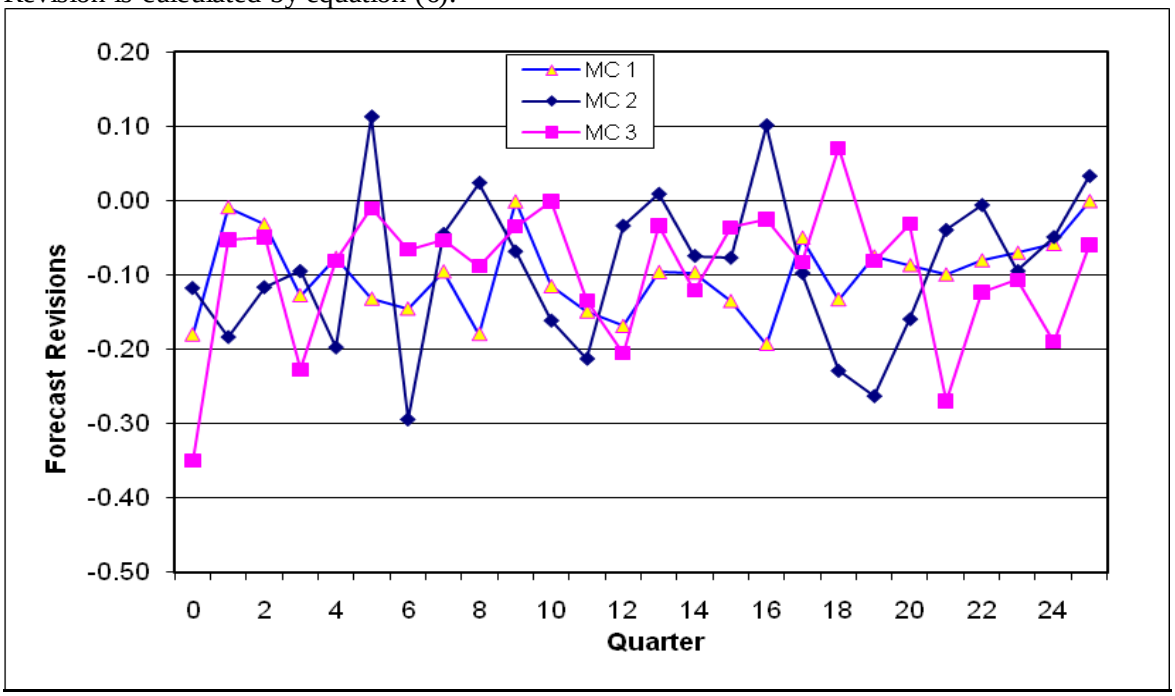
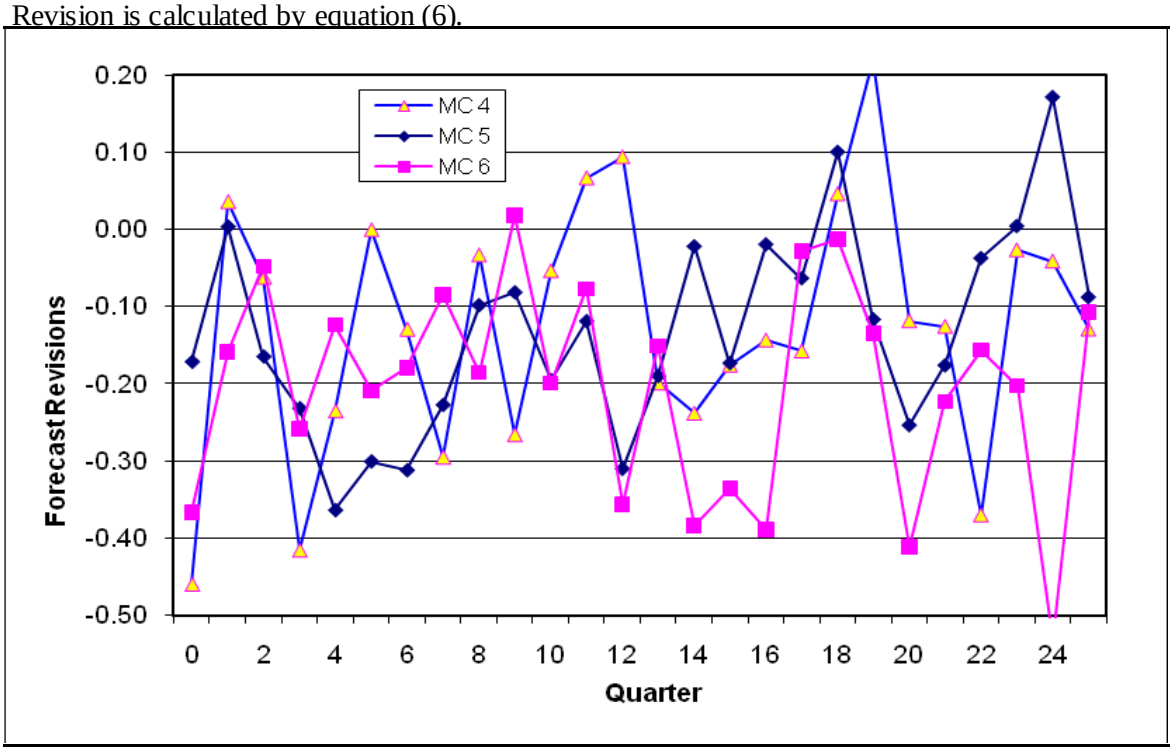


Figure 6. Analyst Quarterly Revisions for MC4, MC5 and MC6 Firms from Quarter 0 to Quarter 24 after the First MC.

Revision is calculated by equation (6).



financial assets they are believed to be more prudent in making investment decisions. Their relatively large financial responsibilities compel them to pay more attention to complex information such as pension related obligations. Since different classes and styles of investors have different investment goals and strategies, they may interpret and react to MC information differently. I conduct institutional investor related analyses using three institutional classes classified by Bushee (1998) and four institutional styles classified by Abarbanell, Bushee and Raedy, (2003), with all classification data provided by Bushee.

Panel A of Table 15 presents Percent of Institutional Holddings (PIH) by three classes and four styles. There is no a clear trend of holdings for different classes and styles of investors from MC1 to MC6 firms, except for the last column of the table that shows that the holdings of large and small growth investors is significantly lower in MC6 than in the other MC groups, indicating that these firms are perceived to lack growth opportunities.

Panel B of Table 15 shows the change of PIH (CPIH) for institutional class and style groups. Like PIH there is no clear trend across MC firm groups. All investor groups change their holdings, mostly in MC5 firms but this is likely due to their higher initial holding in MC5 firms as shown in Panel A. TRA investors whose holdings in MC firms are less than half those of QIX investors do show higher turnover than DED and QIX investors, consistent with their investment strategy. Small investors, with lower holdings in all six MC firm groups, also show higher turnover than large investors. Overall, the evidence suggests that intuitional investors don't adjust their holdings differently across these MC firm groups.

5.4 Interrupted Versus Continuous Mandated Contribution

Table 4 shows that firms with the same number of MC years (columns) can fall in different MC periods (rows). For example, firms with three MC years can make MC in one period of three consecutive years (MC3 in preceding analyses), or in two periods of two

Table 15. Percent of Institutional Holdings (PIH) and Change of PIH (CPIH) by Investment Class and Style for the Six Mandated Contribution (MC) Groups.

The MC groups are defined in Table 10. The three classes and four styles of PIH are as defined by Bushee (1998) and Abarbanell, Bushee and Ready (2003). DED represents dedicated institutions that have low turnover and more concentrated portfolio holdings, QIX (TRA) represent quasi-indexer (transient) institutions with low (high) turnover and diversified portfolio holdings. LVA represents institutions that prefer large firms, which are high on the value and fiduciary dimensions and low on historical growth-risk dimension. LGR represents institutions that hold large firms that have greater future growth potential than firms held by large-value institutions. SVA represents institutions that prefer small-cap firms (though not as small as small-growth funds) that are high on the value dimension and low on the prior growth risk dimension. SGR represents institutions that tend to hold small firms with high historical and expected returns. The last column shows the results of t test of differences between PIH of MC1 and PIH of MC2, MC3, MC4, MC5 and MC6. "Yes" means all five tests are significant at level 0.1 or lower. "No" means at least one test is not significant.

		MC1	MC2	MC3	MC4	MC5	MC6	Ave	MC6 VS MC1-MC5
Panel A. PIH									
Class	DED	0.0853	0.0846	0.0912	0.0872	0.1029	0.0898	0.0872	No
	QIX	0.2498	0.2378	0.2604	0.2790	0.2569	0.2382	0.2499	No
	TRA	0.1030	0.0988	0.1070	0.1042	0.1276	0.0991	0.1033	No
Style	LVA	0.1411	0.1325	0.1400	0.1476	0.1550	0.1379	0.1401	No
	LGR	0.1139	0.1110	0.1042	0.1181	0.1288	0.0988	0.1117	Yes
	SVA	0.0876	0.0857	0.1088	0.0914	0.0934	0.0980	0.0911	No
	SGR	0.0912	0.0909	0.0977	0.0979	0.1067	0.0834	0.0921	Yes
	Ave	0.1086	0.1051	0.1126	0.1139	0.1209	0.1045	0.1088	
Panel B. CPIH									
Class	DED	0.0027	0.0029	0.0031	0.0029	0.0047	0.0032	0.0029	No
	QIX	0.0077	0.0078	0.0080	0.0070	0.0079	0.0078	0.0077	No
	TRA	0.0076	0.0071	0.0081	0.0075	0.0103	0.0068	0.0076	No
Style	LVA	0.0033	0.0034	0.0037	0.0036	0.0040	0.0035	0.0034	No
	LGR	0.0030	0.0033	0.0031	0.0026	0.0036	0.0030	0.0031	No
	SVA	0.0047	0.0051	0.0058	0.0047	0.0060	0.0047	0.0049	No
	SGR	0.0066	0.0063	0.0067	0.0062	0.0093	0.0061	0.0066	No
	Ave	0.0044	0.0045	0.0048	0.0043	0.0057	0.0043	0.0045	

consecutive years and of one year, or in three periods of one year. Even for firms with the same number of MC years and the same number of MC periods, the number of non-MC years between periods may differ. Being free from the MC obligation temporarily may or may not help the firm in the long term. Furthermore, more erratic MC patterns could raise hurdles in the valuation of these firms. In this section, I investigate the effect of recurring MC by comparing non-recurring MC firms with recurring MC firms.

First, I constructed four more MC groups, named MC2R, MC3R, MC4R and MC5R to indicate that these firm groups have same number of MC years over the sample period as MC2, MC3, MC4 and MC5, respectively, except that MC years are continuous for the latter set of firms, but are interspersed with non-MC years for the former group of firms. Note that a MC1R group is not feasible by definition, and a MC6R group would not be directly comparable to the MC6 because the latter contains firms with continuous MC years ranging from 6 to 15. Consequently, I restrict these analyses to comparisons between MC2-MC5 firms and MC2R – MC5R firms, respectively.

Table 16 presents descriptive statistics for the MC2R-MC5R firm groups, using Schedule B data. Columns 2 through 5 show that as the number of MC years increases, the recurring firms' Gateway percentage (ratio of fund current assets to current liabilities) decreases. As a result, recurring firms with longer MC years have larger contribution requirements. In comparison with consecutive firms with the same number of MC years, I find that the recurring firms are characterized by equal or higher Gateway values, lower old and new liability values, as well as lower DRC and MC values.

Table 17 displays the value-weighted and equally-weighted adjusted returns from the market model, three-factor model and four-factor model for the recurring firms. Columns 2 to 5 show that recurring firms generally earn lower excess returns as the number of MC years increases, with the pattern being more consistent for equally-weighted returns. The last four columns show the differences of excess returns between MCX and MCXR

Table 16. Characteristics of the Recurring Mandatory Contribution Group Firms Using Form 5500 Schedule B Data.

MC2R consists of recurring MC firms with 2 MC years in 2 non-adjacent periods, MC3R consists of firms with 3 MC years in 2 or 3 periods, MC4R consists of firms with 4 MC years in 2 or more periods and MC5R consists of firms with 5 MC years in 2 or more periods. McToCurAst is the ratio of MC to current assets; GWAY is the proportion of current assets to current liability; DrcToCurAst is deficit reduction contribution to current assets; OldLiaToCurAst is old liability to current assets; NewLiaToCurAst is new liability to current assets. t statistics are reported in parentheses.

	MC2R	MC3R	MC4R	MC5R	MC2R-MC2	MC3R-MC3	MC4R-MC4	MC5R-MC5
GWAY	0.7313	0.6998	0.6938	0.6163	0.0095	0.0503	0.0411	0.0076
	(43.192)	(54.768)	(48.573)	(40.582)	(0.455)	(2.794)	(2.079)	(0.317)
McToCurAst	0.0044	0.0070	0.0096	0.0121	-0.0032	-0.0069	-0.0043	-0.0106
	(5.654)	(7.375)	(9.574)	(7.501)	(-2.828)	(-3.862)	(-2.359)	(-3.353)
DrcToCurAst	0.0101	0.0178	0.0283	0.0310	-0.0063	-0.0123	-0.0053	-0.0223
	(8.460)	(8.941)	(10.936)	(9.689)	(-3.426)	(-3.576)	(-1.344)	(-3.640)
OldLiaToCurAst	0.0008	0.0006	0.0019	0.0038	-0.0006	-0.0013	-0.0020	-0.0023
	(3.564)	(4.001)	(4.810)	(5.897)	(-1.810)	(-3.245)	(-2.832)	(-1.967)
NewLiaToCurAst	0.0325	0.0441	0.0703	0.0759	-0.0176	-0.0257	-0.0140	-0.0416
	(7.640)	(10.077)	(11.890)	(10.247)	(-2.999)	(-3.339)	(-1.497)	(-2.979)

Table 17. Value-Weighted and Equally-Weighted Returns Adjusted by Market, Three-Factors and Four-Factors for Four Recurring Mandatory Contribution Groups Defined in Table 16 and Matching MC Groups Defined in Table 10.

t statistics are reported in parentheses.

Adjusted Returns	MC2R	MC3R	MC4R	MC5R	MC2R-MC2	MC3R-MC3	MC4R-MC4	MC5R-MC5
				VWRET				
Market	0.0039	0.0025	0.0024	0.0021	-0.0021	-0.0021	-0.0005	-0.0046
	(3.140)	(2.265)	(1.747)	(1.338)	(-1.443)	(-1.371)	(-0.243)	(-1.913)
Three-Factors	-0.0010	0.0030	-0.0019	-0.0010	-0.0052	0.0036	-0.0023	-0.0056
	(-0.813)	(2.703)	(-1.407)	(-0.669)	(-3.555)	(2.361)	(-1.218)	(-2.316)
Four-Factors	0.0015	0.0026	-0.0001	-0.0015	-0.0017	0.0030	-0.0002	-0.0061
	(1.253)	(2.389)	(-0.110)	(-0.970)	(-1.183)	(1.940)	(-0.130)	(-2.507)
				EWRET				
Market	0.0055	0.0034	0.0008	0.0010	-0.0003	-0.0015	-0.0010	-0.0036
	(4.427)	(1.036)	(0.580)	(0.655)	(-0.198)	(-0.968)	(-0.535)	(-1.478)
Three-Factors	-0.0004	-0.0017	-0.0039	-0.0038	-0.0032	-0.0016	-0.0022	-0.0063
	(-0.321)	(-1.045)	(-2.929)	(-2.491)	(-2.190)	(-1.056)	(-1.195)	(-2.620)
Four-Factors	0.0016	-0.0005	-0.0007	-0.0014	-0.0022	-0.0019	-0.0016	-0.0069
	(1.296)	(-1.039)	(-0.541)	(-0.929)	(-1.519)	(-1.284)	(-0.871)	(-2.893)

firms. Almost all signs are negative, showing that recurring MC firms earn less excess returns than consecutive MC firms. Why do the recurring firms earn lower returns in spite of higher funding status and lower liability than consecutive firms as shown in Table 16? A possible explanation is that the market views recurring firms more unfavorably if they are unable to sustain their recovery from the MC requirement. Furthermore, unlike the adjusted returns that show a decreasing trend from MC2R to MC5R, the differences in adjusted returns don't necessarily show a decreasing trend, although the largest differences generally occur in matched 5-year MC group.

CHAPTER 6

FACTOR AND CLUSTER ANALYSIS GROUPINGS

The analyses above show that the market returns of MC firms are affected not only by the number of MC years but also by their pattern. In analyzing the recurring firms in section 4.3, I grouped the recurring MC firms according to the number of MC years without considering any other factors. For example, for the MC2R firms the number of non-MC years between the two MC years is not the same across all firms in the group. It is likely that the distance between consecutive MC periods is a relevant factor, as well as several other considerations. Therefore, a grouping that incorporates more relevant factors is likely to be useful.

I use the following variables in factor analysis in an attempt to capture common factors across MC firms: MCYEAR, the total number of MC years in the sample period; NPMC, the number of MC periods; GWAY, average Gateway percentage that triggers the MC requirement and also reflects the firm's pension underfunded status; GWAY2, the average Gateway percent if the firm's Gateway percentage value falls below 100% in any sample year[7]; DURATION, the ratio of MCYEAR over NPMC, capturing the persistence and continuation of the MC requirement; DIST, the average number of years between successive MC recurrences; and MCYPCT, the ratio of MC years to total number of years in the data.

Panel A of Table 18 reports the correlations of the seven variables used for factor analysis. Not surprisingly MCYEAR is strongly correlated with DURATION and MCYPCT, DURATION is strongly correlated with MCYPCT, and GWAY is strongly

[7] Since GWAY values are averaged over years for a firm, two firms with the same GWAY average may have different MC status at given points in time. For example, compare a firm with GWAY values of 120% and 80% over two years with another firms with a constant 100% GWAY value for both years. Both have the same average GWAY value, but the MC requirement is triggered for the first firm in one year, but not at all for the second firm.

Table 18. The Results of Factor and Cluster Analyses of Mandatory Contribution (MC) Firms.

Panel A. Correlations of Factor Analysis Variables. NPMC is the number of MC periods. MCYEAR is the total number of MC years in the data period. Duration is the ratio of MCYEAR to NPMC. DIST is the average number of non-MC years between MC contribution periods. MCYPCT is the ratio of MCYEAR to total number of years in the data. GWAY is the average of gateway percentage defined as pension fund asset over liability from Schedule B of Form 5500H before 1999 or Form 5500 since. GWAY2 is the average of gateway percentage for years with GWAY less than 1.00 only.

	NPMC	MCYEAR	DURATION	MCYPCT	DIST	GWAY	GWAY2
NPMC		0.258	-0.380	-0.043	0.532	0.089	0.177
MCYEAR			0.722	0.653	0.017	-0.311	-0.052
DURATION				0.608	-0.336	-0.342	-0.162
MCYPCT					-0.237	-0.576	-0.282
DIST						0.170	0.153
GWAY							0.811

Panel B. Standardized Scoring Coefficients and Communality of Factors. Factor1: OCCURR = Occurrence. Factor 2: GWAYPT = Gateway percent contribution. Factor 3: NPERST = Non-persistence of MC.

	Factors			Communality	
Variables	OCCURR	GWYPCT	NPERST	Estimates	Percent
NPMC	0.0001	-0.0267	0.4488	0.7929	15.33%
MCYEAR	0.5616	0.0294	0.5349	0.9078	17.55%
DURATION	0.3253	0.0577	-0.6035	0.8775	16.96%
MCYPCT	0.1256	-0.0017	-0.0900	0.6279	12.14%
DIST	-0.0273	0.0156	0.1151	0.3591	6.94%
GWAY	-0.1259	0.6178	-0.1784	0.8565	16.56%
GWAY2	0.0671	0.3446	0.0295	0.7511	14.52%
Variance %	41.0%	33.4%	25.7%		

Panel C. Factor Loadings of Clusters

Cluster	OCCURR	GWAYPCT	NPERST	Firms	Firms(%)
LEN	-0.4803	0.3631	0.1380	581	68.43%
PER	1.3944	-0.1941	-0.1519	182	21.44%
REV	0.2940	-2.0426	-0.6111	86	10.13%

Panel D. Cluster Means for the Factor Analysis Variables

	LEN				PER				REV			
Variables	mean	std	min	max	mean	std	min	max	mean	std	min	max
NPMC	1.79	0.90	1.00	7.00	1.67	0.77	1.00	4.00	1.26	0.47	1.00	3.00
MCYEAR	3.55	1.55	2.00	9.00	8.75	2.57	4.0	15.00	4.51	2.25	2.00	12.00
DURATION	2.22	0.97	1.00	5.00	6.10	2.83	2.33	15.00	3.84	2.12	1.00	12.00
MCYPCT	0.35	0.18	0.13	1.00	0.77	0.17	0.39	1.00	0.71	0.24	0.17	1.00
DIST	0.95	1.24	0.00	6.50	0.45	0.61	0.00	3.00	0.21	0.47	0.00	3.00
GWAY	93.27	4.19	77.88	100.00	86.25	5.45	70.87	97.08	71.13	11.22	32.70	94.06
GWAY2	86.30	7.21	50.50	100.00	82.89	6.22	64.64	95.91	60.68	15.47	10.26	80.20

correlated with GWAY2. Also as expected, there is a strong negative correlation between MCYPCT and GWAY. But the strong positive correlation between NPMC and DIST is a little surprising. As one would expect DIST, that measures the distance (non-MC years) between successive MC periods should decreases as NPMC increases. Reexamining the distribution of MC firms in Table 4, I find a V-shaped distribution between NPMC and MCYEAR. As MCYEAR increases, NPMC increases until period 5 then decreases gradually. The non-MC years between NPMC will increase if MCYEAR increases and NPMC stays the same, possibly explaining the positive correlation between NMPC and DIST. NPMC is also moderately correlated with MCYEAR and negative correlated with DURATION. GWAY and GWAY2 are negatively correlated with MCYEAR, MCYPCT and DURATION.

Because many variables are highly correlated with absolute correlation coefficients greater than 0.5, I perform principal factor analysis with an oblique rotation to identify and interpret common factors (Bushee 1998). The factor analysis produces three common factors, reported in Panel B of Table 18. The OCCURR factor appears to capture the occurrence of MC, with factor loadings on MCYEAR and MCYPCT being the highest. The GWYPCT factor appears to measure proximity to the mandated contribution threshold, with factor loadings on GWAY and GWAY2 being the highest. The NPERST factor appears to captures non-persistence of firm's MC strings, with the three highest factor loadings being provided by DURATION, NPMC and MCY. The large negative factor loading of DURATION in NPERST indicates these firms are recurring firms with both higher number of MC years and periods.

After identifying the three common factors, I then perform cluster analysis using the standardized factor scores. Panel C of Table 18 reports the results of the cluster analysis. Cluster LENIENT (LEN) has highest GWYPCT, lowest OCCURR and highest NPERST values. Cluster PERPETUAL (PER) has the highest OCURR value, and low GWAY and

NPERST values. Cluster REVERT (REV) has the lowest GWAYPCT (high pension shortfall), lowest NPERST, and high OCCURR. The means of the factor analysis variables for the three clusters are shown in Panel D of Table 18. The results confirm the cluster analysis groupings. LEN firms have lower MCYEAR, lower DURATION, and higher GWAYPCT and DIST, indicating that these firms possess lower pension liability and are able to fulfill the pension funding requirement with short term mandatory contribution periods. PER firms have higher MCYEAR and MCYPCT, and large DIST and DURATION indicating that these firms tend to have more consecutive MC years. REV firms have the lowest GWAY and DIST, indicating that these firms have the highest pension shortfall and a new MC requirement recurs more quickly after a stop in MC. REV firms also have low DURATION.

I now classifying all firms into five groups: NMC (firms with no mandated contribution during the sample period), ONCE (firms with just one MC year over the whole sample), and LEN, PER and REV (groups identified from the factor and cluster analyses).

6.1 Descriptive Statistics

Table 19 reports descriptive statistics for the NMC, ONCE, LEN, PER and REV firm groups. Several inferences can be drawn from the table. REV firms are smallest in size, report the lowest earnings and operating cash, pay the least dividends, issue most long-term debt, are most underfunded, incur highest pension related costs (interest, pension, service, other pension, prior service), and show lowest yearly returns, return on asset (ROA) and return on equity (ROE). NMC firms pay the most dividends, show the highest funding status, the least long-term debt, interest cost and pension cost and highest yearly returns. They are smaller than ONCE firms and report less net income, ROA and ROE than ONCE firms. Overall, however, NMC firm characteristics are very similar to those of ONCE firms.

Table 19. Descriptive Statistics of NMC, ONCE, LEN, PER and REV Firms.

NMC represents the firms with no mandated contribution. ONCE includes firms that made only once mandated contribution. LEN, PER and REV are groups identified from factor and cluster analyses.

	NMC		ONCE		LEN		PER		REV	
Variable	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
TA	6553.28	14621.36	7138.17	16212.19	3878.29	10051.08	4261.16	9464.40	3691.89	11436.02
MktCap	3199.02	6853.70	3756.23	7775.89	2972.82	6785.89	2966.35	7111.14	1099.23	3333.30
NOA	0.5536	0.2948	0.6132	0.2568	0.6517	0.2334	0.6398	0.2266	0.5912	0.2788
TotAccru	-0.0501	0.0721	-0.0523	0.0709	-0.0529	0.0723	-0.0489	0.0757	-0.0530	0.1026
NI	0.0416	0.0710	0.0443	0.0718	0.0409	0.0795	0.0292	0.0851	0.0116	0.1122
OCF	0.0959	0.0714	0.1016	0.0732	0.0955	0.0695	0.0789	0.0703	0.0758	0.0822
R&D	0.0337	0.0373	0.0366	0.0373	0.0275	0.0277	0.0252	0.0274	0.0310	0.0355
CapExp	0.0591	0.0456	0.0607	0.0461	0.0603	0.0399	0.0504	0.0342	0.0554	0.0505
Acquisn	0.0191	0.0528	0.0229	0.0550	0.0245	0.0575	0.0267	0.0628	0.0110	0.0404
Dividend	0.6582	0.6222	0.5605	0.5995	0.4755	0.5672	0.4149	0.4864	0.3393	0.5341
LTD	0.1992	0.1724	0.2059	0.1661	0.2381	0.1715	0.2592	0.1803	0.2455	0.2062
LTDissue	0.0837	0.1400	0.0852	0.1420	0.0933	0.1558	0.0986	0.1507	0.1332	0.2160
FV	436.75	1133.86	532.45	1236.79	568.74	1396.85	744.64	1679.51	255.23	1369.73
PBO	454.23	1237.01	547.81	1280.53	570.66	1382.00	804.25	1782.77	332.94	1692.10
FvToTa	0.1335	0.1411	0.1486	0.1557	0.1694	0.1533	0.1830	0.1502	0.0929	0.1212
PboToTa	0.1281	0.1306	0.1485	0.1497	0.1726	0.1458	0.2005	0.1531	0.1194	0.1398
FvToPbo	1.0232	0.2611	0.9738	0.2297	0.9427	0.2400	0.8936	0.2108	0.6682	0.2712
FR	0.0173	0.2591	-0.0126	0.3740	-0.0386	0.4880	-0.0918	0.6329	-0.1820	0.5945
Fstatus	0.0059	0.0415	-0.0003	0.0377	-0.0045	0.0459	-0.0149	0.0513	-0.0325	0.0430
OBSliab	-0.0051	0.0235	-0.0019	0.0235	0.0041	0.0277	0.0052	0.0243	0.0137	0.0243
CompRate	4.7872	0.7712	4.7187	0.7172	4.7372	0.7335	4.7102	0.8368	4.8473	1.0422
DiscRate	7.3435	0.7035	7.3451	0.7330	7.4188	0.7227	7.4268	0.7664	7.3950	0.8137
IntCost	0.0688	0.0189	0.0731	0.0220	0.0762	0.0230	0.0805	0.0199	0.1096	0.0429
PenCost	0.0020	0.0050	0.0030	0.0051	0.0036	0.0058	0.0050	0.0058	0.0053	0.0061
ServCost	0.0488	0.0531	0.0484	0.0504	0.0447	0.0401	0.0403	0.0363	0.0654	0.1824
OthPCost	0.0168	0.0598	0.0191	0.0581	0.0207	0.0582	0.0226	0.0565	0.0505	0.0732
PriorSC	0.1470	0.3429	0.1690	0.3302	0.1779	0.3014	0.1535	0.3534	0.1815	0.3135
ERR	8.6067	0.8061	8.5893	0.7750	8.7960	0.9604	9.0720	0.8160	8.4167	0.7536
RET	0.0774	0.3577	0.0703	0.3817	0.0664	0.3945	0.0365	0.4028	0.0030	0.4559
ROA	0.0096	0.0169	0.0101	0.0175	0.0094	0.0191	0.0068	0.0196	0.0020	0.0292
ROE	0.0291	0.0627	0.0307	0.0755	0.0259	0.0793	0.0252	0.0937	0.0114	0.1176

Table 20 reports mean values for BE/ME, E/P, monthly return and size adjusted returns for NMC, ONCE, LEN, PER and REV firm groups as well as all MC firms in the aggregate. Results show that the NMC and ONCE firms are generally similar in earnings, returns and size adjusted returns. However, NMC firms have higher BE/ME values. They are larger firms as shown in Table 19, and report higher earnings and returns than LEN, PER and REV firms. LEN and PER firms are similar in size and BE/ME values, but LEN firms show higher earnings, returns and size adjusted returns than PER firms. The REV firms are the smallest in size, BE/ME, earnings and size adjusted return. The averaged monthly return shows that all six groups earn significantly positive monthly raw returns but NMC and ONCE groups earn the highest raw returns (1.2%) while PER and REV earn the lowest raw returns (0.7%). The bottom row shows that the aggregated MC firm group earns 0.17% less monthly returns than NMC group. The raw returns show a decreasing trend from the ONCE group to the REV group. Although all of size adjusted returns are negative, they display a similar trend to the raw returns. NMC and ONCE earn the highest size adjusted returns while PER and REV earn the lowest. The difference of size adjusted returns between NMC and MC is 0.18%, very close to the raw return difference.

Table 21 shows the differences of raw and size adjusted returns between NMC, ONCE and classified MC groups. There are no significant differences between raw and size adjusted returns between the NMC and ONCE firms or between the PER and REV firms, but differences between the other groups are significant.

6.2 Risk Adjusted Returns

Table 22 shows the risk-adjusted returns from the three regression models for the five firm groups. The adjusted returns from all three models are significantly positive for the NMC and ONCE firms, except for the equally-weighted three-factor adjusted return for

Table 20. Mean and t-stats of Book Equity to Market Equity (BE/ME), Earning to Price (E/P), Monthly Returns (Ret) and Size Adjusted Returns (Size Adjusted Ret) for NMC, ONCE, LEN, PER, REV and MC Firms.

NMC represents firms with no mandated contribution. ONCE includes firms that made only one mandated contribution during the sample period. LEN, PER and REV are groups identified from factor and cluster analyses. MC represents all firms with a mandated contribution during the sample period.

	BE/ME		E/P		Ret (Monthly)		Size Adjusted Ret	
Firm Groups	Mean	t-stat	Mean	t-stat	Mean	t-stat	Mean	t-stat
NMC	0.0698	31.78	0.0026	0.27	0.0118	45.98	-0.0006	-2.52
ONCE	0.0471	12.17	-0.0036	-0.19	0.0119	21.68	-0.0003	-0.52
LEN	0.0457	12.24	-0.0317	-2.58	0.0101	24.10	-0.0024	-5.89
PER	0.0471	6.42	-0.1061	-3.40	0.0069	8.10	-0.0054	-6.58
REV	0.0112	0.57	-0.1246	-2.37	0.0072	4.38	-0.0069	-4.28
MC	0.0451	17.08	-0.0395	-4.01	0.0101	32.83	-0.0024	-8.12

Table 21. Differences and P-values (in parentheses) of Raw Returns and Size Adjusted Returns for NMC, ONCE, LEN, PER, REV and MC Groups.

Raw returns differences are above the diagonal. Size adjusted returns differences are below the diagonal. F tests don't show unequal variances.

	NMC	ONCE	LEN	PER	REV	MC
NMC		-0.0001	0.0018	0.0050	0.0045	0.0018
		(0.843)	(0.000)	(0.000)	(0.006)	(0.000)
ONCE	-0.0003		0.0018	0.0050	0.0046	
	(0.595)		(0.010)	(0.000)	(0.009)	
LEN	0.0017	0.0020		0.0033	0.0028	
	(0.000)	(0.003)		(0.001)	(0.100)	
PER	0.0046	0.0053	0.0034		0.0000	
	(0.000)	(0.000)	(0.000)		(0.982)	
REV	0.0058	0.0069	0.0049	0.0006		
	(0.000)	(0.000)	(0.003)	(0.753)		
MC	0.0018					
	(0.000)					

Table 22. Value-Weighted and Equally-Weighted Returns Adjusted by Market, Three-Factors and Four-Factors for NMC, ONCE, LEN, PER and REV Firm Groups.

NMC represents firms with no mandated contribution. ONCE includes firms that made only one mandated contribution during the sample period. LEN, PER and REV are groups identified from factor and cluster analyses.

	VWRET					EWRET				
	NMC	ONCE	LEN	PER	REV	NMC	ONCE	LEN	PER	REV
					Market adjusted Returns					
Mean	0.0052	0.0038[A]	0.0040[AB]	0.0018[ABC]	-0.0008[ABC]	0.0063	0.0052	0.0037[AB]	0.0006[ABC]	0.0017[AB]
	(20.956)	(6.992)	(9.504)	(2.022)	(-0.467)	(25.487)	(9.553)	(8.945)	(0.742)	(0.959)
Median	0.0027	0.0017	0.0022	0.0007	-0.0054	0.0037	0.0026	0.0020	-0.0005	-0.0026
					Three-Factor Adjusted Returns					
Mean	0.0039	0.0045	0.0016[AB]	-0.0019[ABC]	-0.0028[ABC]	0.0014	0.0004	-0.0015[AB]	-0.0061[ABC]	-0.0031[ABd]
	(15.464)	(8.191)	(3.779)	(-2.199)	(-1.549)	(5.575)	(0.773)	(-3.740)	(-7.159)	(-1.735)
Median	0.0013	0.0022	-0.0001	-0.0030	-0.0063	-0.0013	-0.0018	-0.0032	-0.0081	-0.0082
					Four-Factor Adjusted Returns					
Mean	0.0043	0.0068[A]	0.0016[AB]	-0.0007[ABC]	-0.0016[AB]	0.0026	0.0023	0.0005[AB]	-0.0038[ABC]	-0.0006[abd]
	(17.279)	(12.245)	(3.861)	(-0.824)	(-0.886)	(10.428)	(4.296)	(1.233)	(-4.482)	(-0.368)
Median	0.0016	0.0044	-0.0001	-0.0017	-0.0054	-0.0001	-0.0001	-0.0011	-0.0058	-0.0041

[A(a)] indicates the mean is significantly different from NMC firms at 0.01 (0.05) level.
[B(b)] indicates the mean is significantly different from ONCE firms at 0.01 (0.05) level.
[C(c)] indicates the mean is significantly different from LEN firms at 0.01 (0.05) level.
[D(d)] indicates the mean is significantly different from PER firms at 0.01 (0.05) level.

ONCE firms that is not different from zero. For PER and REV firms, the adjusted returns are either significantly negative or not different from zero. The LEN firms show mixed results, positive for the market model and the value weighted three-factor model, negative for the equally-weighted three-factor model and not different from zero for the four-factor model. The largest difference in value-weighted returns is .84%, between ONCE and REV firms for the four-factor model, and the largest difference in equally-weighted returns is .75%, between NMC and PER for the three-factor model. The adjusted returns from the three-factor and four-factor models are all negative for PER and REV firms and positive for NMC and ONCE. Although not all risk-adjusted returns of REV are significant, we should keep in mind that the REV group has the smallest size. The overall results show that NMC and ONCE groups earn positive risk-adjusted returns in most cases, while PER and REV groups earns negative or zero risk-adjusted returns in all cases. The differences between NMC and ONCE firms on the one hand, and the PER and REV firms, on the other, are significant.

Table 23 reports the cumulated risk adjusted returns one quarter and one year to five years after the first MC occurrence. NMC firms are excluded because the first MC date is required for this analysis. Since most companies release their 10K three months after the fiscal year end, I use three months after the fiscal year end as the starting date to calculate accumulated market adjusted returns.

All risk-adjusted returns show that ONCE firms earn consistent and increasingly positive returns that are higher than all other MC firm groups. LEN firms earn increasing positive adjusted returns in all cases, except one: the adjusted three-factor equal weighted returns are not different from zero. PER firms earn positive cumulated market adjusted returns at year five although returns are lower than those of ONCE and LEN firms. The adjusted three-factor or four-factor returns for PER firms are either negative or not significantly from zero at year five. REV firm returns are mixed, but not significantly

Table 23. Cumulated Returns for ONCE, LEN, PER and REV Firms.

The cumulated returns for six periods are calculated with the fiscal year ending of the first mandatory contribution (MC) as a starting point. Pstq1, Psty1, Psty2, Psty3, Psty4 and Psty5 are the cumulated returns of one quarter, one year, two years, three years, four years and five years after the fiscal year ending of the first MC. Value-weighted (VWRET) and equally-weighted (EWRET) returns are adjusted by market, three-factors and four-factors. ONCE includes firms that made only one mandated contribution during the sample period. LEN, PER and REV are groups identified form factor and cluster analyses.

	VWRET								EWRET							
	ONCE		LEN		PER		REV		ONCE		LEN		PER		ERV	
	Mean	t-stat	Mean	t-stat	Mean	t-stat	Mean	t-stat	Mean	t-stat	Mean	t-stat	Mean	t-stat	Mean	t-stat
Market Adjusted Returns																
Pstq1	0.0503	3.051	0.0461	4.025	0.0530	2.178	-0.0167	-0.319	0.0552	3.367	0.0457	3.986	0.0487	2.028	-0.0150	-0.283
Psty1	0.0451	1.782	0.0662	3.464	-0.0012	-0.032	0.0255	0.342	0.0634	2.468	0.0638	3.349	-0.0117	-0.310	0.0488	0.639
Psty2	0.1291	2.980	0.1813	6.000	0.0908	1.526	-0.0393	-0.422	0.1688	3.888	0.1749	5.815	0.0624	1.066	0.0121	0.126
Psty3	0.2341	4.019	0.2454	6.625	0.1570	2.268	0.2440	1.344	0.3012	4.998	0.2358	6.409	0.1249	1.828	0.2301	1.521
Psty4	0.3050	3.995	0.2627	5.690	0.1128	1.472	0.0953	0.501	0.4000	5.144	0.2595	5.486	0.1023	1.187	0.2762	1.274
Psty5	0.3995	3.909	0.3236	5.848	0.2029	2.096	0.1655	0.642	0.5190	4.839	0.3027	5.534	0.1225	1.361	0.4207	1.382
Three-Factor Adjusted Returns																
Pstq1	0.0527	3.711	0.0096	0.900	-0.0346	-1.491	0.0239	0.740	0.0225	1.435	-0.0021	-0.193	-0.0241	-1.107	-0.0467	-0.919
Psty1	0.0535	2.094	0.0017	0.099	-0.0783	-2.170	0.0069	0.100	0.0000	0.000	-0.0214	-1.232	-0.1020	-2.757	-0.0439	-0.642
Psty2	0.1205	2.969	0.0739	2.680	-0.0299	-0.526	0.0154	0.126	0.0152	0.451	0.0036	0.141	-0.1719	-4.046	-0.1349	-1.747
Psty3	0.2386	4.031	0.1045	2.936	-0.0641	-1.101	0.1101	0.705	0.0932	1.893	0.0067	0.230	-0.1552	-3.109	0.1571	1.002
Psty4	0.2494	3.442	0.0964	2.286	-0.0540	-0.732	0.0982	0.507	0.1540	2.476	-0.0155	-0.427	-0.2040	-3.427	0.0827	0.478
Psty5	0.3402	3.121	0.1019	2.080	-0.1067	-1.601	0.1825	0.783	0.1773	2.229	0.0059	0.146	-0.1775	-2.376	0.1878	0.832
Four-Factor Adjusted Returns																
Pstq1	0.0572	3.392	0.0238	2.150	0.0199	0.813	-0.0243	-0.480	0.0242	1.544	-0.0025	-0.237	-0.0186	-0.835	-0.0410	-0.795
Psty1	0.0682	2.716	0.0269	1.478	-0.0397	-1.009	0.0020	0.028	0.0272	1.079	-0.0032	-0.181	-0.0774	-2.045	0.0321	0.393
Psty2	0.1937	4.304	0.0975	3.445	-0.0232	-0.452	-0.0658	-0.783	0.0630	1.783	0.0597	2.186	-0.1118	-2.487	-0.0762	-0.927
Psty3	0.3073	5.309	0.1340	3.884	0.0244	0.401	0.2514	1.436	0.1654	3.143	0.0749	2.461	-0.0764	-1.419	0.2784	1.593
Psty4	0.3918	5.183	0.1153	2.659	-0.0063	-0.084	0.1510	0.787	0.2774	3.982	0.0943	2.342	-0.0951	-1.424	0.2493	1.258
Psty5	0.4969	4.910	0.1123	2.387	0.0104	0.130	0.2646	1.027	0.3308	3.671	0.1597	3.400	-0.0347	-0.398	0.4359	1.646

different from zero. These results corroborate those in Table 22. ONCE and LEN firms earn higher cumulated returns than PER and REV firms. The number of MC years is the highest for PER firms, 8.7 years on average. The consistent negative signs of thee-factor and four-factor adjusted returns for PER firms show that the market responds negatively to firms with more MC years. In contrast, the more erratic MC pattern for REV firms is probably responsible for the mixed positive and negative returns that these firms exhibit.

6.3 Earnings Surprises and Market Reactions

When firms make mandated contributions, their cash flow and earnings will be affected and consequently, the impact on financial statements, if observed by investors, will be reflected in market returns. Due to the complexity of pension accounting, the market may not be able to comprehend pension costs completely or immediately. For example, firms sponsoring DB plans do not record the cash contribution to the pension plan as an expense, instead treating the net periodic pension cost (NPPC) as an expense in its income statement. The NPPC equals the annual accrued costs of the pension plan minus the expected return on plan assets. In addition, sponsoring firms only disclose the economic value of pension plans in footnotes when releasing financial statements. Is the market surprised when the implications of the MC requirement begin to register in future firm performance? In this section, I investigate market reactions to earnings surprises of MC firms. I look at standardized unexpected earnings, three days cumulated returns, and risk adjusted returns around the announcement from one quarter, and one year to five years after the first MC occurrence. Again, NMC firms are excluded because the first MC occurrence date is required for this analysis.

If firms make MC payments, their cash flow and earnings are likely to be affected. If the market does not fully understand the implications of current MC payments for future earnings, adverse changes in future earnings will come as a surprise. In this

sub-section, I measure market reactions around MC firms' earning announcements. I use standardized unexpected earnings to capture earnings surprises, and four different measures of market reactions. Standardized unexpected earnings (SUE) is defined as follows:

$$SUE_{it} = (e_{it} - e_{it-4}) / \sigma_{it} \qquad (9)$$

Where e_{it} is quarterly earnings in quarter t, e_{it-4} is quarterly earnings 4 quarters before t, and σ_{it} is stand deviation of unexpected earnings over the preceding 8 quarters.

The four measures of market reactions are as follows:

i) Three days' accumulated returns around the earnings announcement

$$CR_{it} = \Sigma r_{ij} \qquad (10)$$

Where i represents stock i, t represents period, and j is from -1 day to 1 day with zero being the earnings announcement date.

ii) Three days' accumulated market-adjusted returns centered around the earnings announcement

$$MKTACR_{it} = \Sigma (r_{ij} - b_i EXM_t) \qquad (11)$$

iii) Three days' accumulated three-factor model adjusted returns centered around the earnings announcement

$$3FACR_{it} = \Sigma (r_{ij} - b_i EXM_t - h_i HML_t - s_i SMB_t) \qquad (12)$$

iv) Three days' accumulated four-factor model adjusted returns centered around the earnings announcement

$$4FACR_{it} = \Sigma (r_{ij} - b_i EXM_t - h_i HML_t - s_i SMB_t - m_i UMD_t) \qquad (13)$$

Table 24 reports the measured surprises and shows the means of SUE, CR and cumulated announcement returns adjusted for risk. SUE means, measuring expectations over a longer period than the 3-day window used for returns, show that for ONCE firms, there is no earnings surprise for the first quarter, but there are positive surprises for years 1 to 3. For LEN and PER firms there is a negative earnings surprise in the first quarter,

Table 24. Unexpected Earnings and Market Reactions.

Standardized Unexpected Earnings (SUE), Three Days (-1, 0, 1) Cumulated Returns and Risk Adjusted Returns around Quarterly Announcement Date. With the fiscal quarter ending before the first mandated contribution occurrence as a starting point, each period measure is calculated by summing the quarterly surprises. VW (EW) represents value (equally) weighted returns. CR is cumulated raw return for three days around the earnings announcement, MKTACR is the market adjusted return over the three days around the earnings announcement, 3FACR (4FACR) is the three-factor (four-factor) adjusted return in the three days around the earnings announcement. 1q is the first quarter announcement return, 1y, 2y, 3y, 4y and 5y are the summarized announcement period returns. ONCE includes firms that made only one mandated contribution during the sample period . LEN, PER and REV are groups identified from factor and cluster analysis.

	ONCE	LEN	PER	REV	ONCE	LEN	PER	REV
		SUE				CR		
1q	0.0080	-0.2731*	-0.3712**	-0.2497	0.0129***	0.0162***	0.0055	-0.0098
1y	1.2235***	0.1201	0.0535	1.5012	0.0186**	0.0306***	- 0.0141	0.0344
2y	0.6050**	1.1633***	-0.0627	0.8536	0.0051	0.0358***	0.0192*	0.0458**
3y	0.5758*	1.1852***	0.3947	0.2907	0.0164*	0.0275***	0.0331*	0.0779
4y	0.2459	0.5142	-0.1459	0.3724	0.0219***	0.0417***	0.0350*	0.0177
5y	0.2656	0.3064	0.5820	1.3313	0.0119	0.0354***	0.0188	-0.0164
		VW: MKTACR				EW: MKTACR		
1q	-0.0174**	-0.0044	-0.0239**	-0.0063	-0.0129*	-0.0056	-0.0348***	-0.0057
1y	-0.0526***	-0.0753***	-0.0784***	0.0273	-0.0450***	-0.0806***	-0.1125***	0.0165
2y	-0.0320**	-0.0197	-0.0378*	-0.0675	-0.0256*	-0.0242	-0.0615**	-0.0744
3y	-0.0807***	-0.0276	-0.0606**	-0.0219	-0.0663***	-0.0360	-0.0822**	-0.0494**
4y	-0.0693***	-0.0609***	-0.0422	-0.1028***	-0.0743***	-0.0692***	-0.1132***	-0.1157**
5y	-0.0142	-0.0379*	-0.0424	0.0181	-0.0048	-0.0379	-0.0776**	0.0443
		VW: 3FACR				EW: 3FACR		
1q	-0.0152*	-0.0198**	-0.0322*	-0.0462	-0.0366***	-0.0416***	-0.0773***	-0.0447
1y	-0.0637***	-0.1040***	-0.1208***	0.0055	-0.0464***	-0.0906***	-0.1173***	0.0811*
2y	-0.0502***	-0.0643***	-0.0939***	-0.0955**	-0.0599***	-0.0451**	-0.1165***	-0.0744
3y	-0.0827***	-0.0653***	-0.0943***	-0.0545**	-0.0483***	-0.0393**	-0.1052***	-0.0710
4y	-0.1056***	-0.1037***	-0.1005***	-0.1436**	-0.0331*	-0.0316	-0.0183	-0.1438*
5y	-0.0362	-0.0419*	-0.0400	-0.0512	-0.0358	-0.0621***	-0.0814**	0.0366
		VW: 4FACR				EW: 4FACR		
1q	-0.0134	-0.0236***	-0.0293*	-0.0466	-0.0256***	-0.0408***	-0.0717***	-0.0413
1y	-0.0421***	-0.1121***	-0.1146***	0.0315	-0.0346**	-0.0978***	-0.1096***	0.0935**
2y	-0.0381**	-0.0693***	-0.0920***	-0.0823	-0.0293**	-0.0480***	-0.1129***	-0.0900
3y	-0.0830***	-0.0679***	-0.0961***	-0.0536*	-0.0222	-0.0375**	-0.0964***	-0.0582
4y	-0.0996***	-0.1018***	-0.1058***	-0.1156*	-0.0223	-0.0369*	-0.0048	-0.1404**
5y	-0.0480*	-0.0471**	-0.0343	-0.0491	-0.0122	-0.0509**	-0.0750**	0.0418

*, **, *** represent significance at the 0.10, 0.05 and 0.01 level, respectively.

and no earnings surprise for the first year. LEN firms show positive earnings surprise in years 2 and 3, while PER firms show no significant earnings surprise. First quarter earnings surprise for REV firms is negative, but the following years show no significant earnings surprise. Most of the cumulated announcement returns (CRs) for ONCE and all CRs for LEN are positive, while those for PER firms are positive (marginally significant) from year 2 to 4. Cumulated returns for REV firms are positive only in year 2. Once again, ONCE and LEN show higher CR more frequently than PER and REV firms. After adjusting for market risk, almost all significant returns around announcements are negative. The three-factor and four-factor CRs show similar results. While it is hard to say that negative risk adjusted returns are associated with negative earning news given the results for SUE, the fact that all risk- adjusted returns for ONCE and LEN are higher than for PER and REV firms confirms that the market reacts more negatively to PER and REV firms' earnings announcements following an MC occurrence than to those of ONCE and LEN firms.

6.4 Analyst Forecasts

Panel A of Table 25 reports 20 quarters of analyst forecasts and revisions for the four MC firm groups after the first MC occurrence. I only report the results of mean forecasts and revisions because the results of median forecasts and revisions are essentially the same. The averaged quarterly forecasts show that analysts take MC into consideration and forecast ONCE and LEN firms correctly. However, they do not differentiate between PER firms and ONCE and LEN firms. As a result, they make large forecast errors (FE) for PER firms. Lower forecasts for REV firms show that analysts are able to identify these MC firms and forecast them differently. This argument is supported by the small and insignificant forecast error for REV firms. HLDIF, the difference between the highest and lowest forecast estimates scaled by the preceding month's price,

Table 25. Analyst Quarterly Forecasts and Revisions for ONCE, LEN, PER and REV Firms.

Forecast is the average of 20 quarterly earnings forecasts starting after the firm's first MC occurrence. FE is the forecasted earnings mean minus actual earnings per share scaled by the price of the preceding month multiplied by 100. HLDIF is the highest forecast minus lowest forecast in the quarter scaled by the price of the preceding month. MMDIF is the forecasted mean minus median in the quarter scaled by the price of the preceding month. AbsFE is the absolute value of FE. NRev is the number of analysts who made revisions during the forecast quarter. Followings is the number of analysts who have at least one forecast during the quarter. NRev% is the ratio of NRev to Followings. REV is the mean of quarterly revisions. ABSREV is the mean of the absolute value of quarterly revisions. NegRev% is the proportion of negative revisions and PosRev% is the proportion of positive revisions. ONCE includes firms that made only one mandated contribution during the sample period. LEN, PER and REV are groups identified from factor and cluster analysis. All estimates are means with t values in parentheses.

Panel A. Analyst Forecasts.

MC Firms	Mean	FE(Mean)	HLDIF	MMDIF	AbsFE
ONCE	0.328	-0.007	0.231	0.002	0.283
	(55.610)	(-0.431)	(32.470)	(2.055)	(18.436)
LEN	0.320	0.001	0.260	0.002	0.312
	(77.039)	(0.112)	(45.315)	(2.671)	(26.549)
PER	0.312	0.092	0.290	0.002	0.358
	(35.543)	(2.985)	(23.828)	(1.665)	(12.371)
REV	0.177	-0.020	0.341	0.004	0.920
	(10.156)	(-0.162)	(10.407)	(1.279)	(8.536)

Panel B. Analyst Revisions

	NRev	Followings	NRev%	MeanRev	AbsRev	NegRev%	PosRev%
ONCE	3.757	8.089	0.483	-0.101	0.234	0.568	0.432
	(34.306)	(59.691)	(18.947)	(-10.469)	(26.419)		
LEN	3.208	6.636	0.502	-0.124	0.281	0.649	0.371
	(45.557)	(85.022)	(54.812)	(-15.718)	(39.528)		
PER	2.901	6.710	0.467	-0.174	0.301	0.699	0.302
	(26.587)	(45.928)	(75.967)	(-11.130)	(21.364)		
REV	3.518	6.044	0.573	-0.121	0.528	0.638	0.364
	(11.591)	(18.947)	(39.588)	(-1.933)	(9.933)		

measures the dispersion among the forecasts. That HLDIF increases from ONCE to REV firms indicates there is an increasing disagreement among analysts as we move from ONCE to REV firms. REV firms with the lowest forecast mean display the largest dispersion among analysts' forecasts, indicating the lack of consensus among analysts on these firms. MMDIF, the difference between the mean and median forecast scaled by the preceding month's price, measures the skewness of the forecast. Positive values indicate skewness to the left and negative values indicate skewness to the right. All MMDIF means are positive, indicating that forecasts are skewed to the left, i.e., there are more low forecast estimates among analysts. The absolute forecast error (AbsFE) is the magnitude of the forecast error regardless of direction and a measure of analyst forecast accuracy. Results clearly indicate that forecast accuracy decreases from ONCE to REV firms, providing evidence that the complexity of MC affects analyst forecast accuracy. For REV firms, AbsFE is about three times as high as for ONCE and LEN firms, suggesting that these firms are more difficult to forecast, the unbiased forecast mean being due to the cancelation of positive and negative forecasts. The overall evidence shows that analysts forecast ONCE and LEN firms more accurately than PER and REV firms.

Panel B of Table 25 reports analysts' quarterly revisions averaged over twenty quarters after the first MC occurrence. Of all four groups, ONCE firms have the largest average number of revisions and the greatest analyst following. But in terms of number of revision per analyst, REV firms have the highest, indicating that analyst in this firm group have the most frequent revisions. Mean revisions are all negative, suggesting that analysts initially overestimate earning. They subsequently revise their estimate downwards. This is supported by the additional evidence shown in the last two columns of Panel B, indicating that the proportion of negative revisions (NegRev%) is higher than that of positive revisions for all MC firm groups. The mean revision for PER firms is

larger than for ONCE, LEN and REV firms, supporting the findings in Panel A that analyst forecasts for PER firms are largely overestimated. The absolute values of revisions (AbsRev) increase from ONCE to REV firms, indicating that the new information becomes more relevant to analysts for more severely impacted MC firms. Results from Panels A and B suggest that MC occurrences do affect analyst forecasts, and the accuracy of the forecasts depends on the complexity and severity of firms' MC patterns.

Figures 7 and 8 depict the forecast errors and revisions from the first quarter to the 20^{th} quarter after the first MC occurrence for the four MC firm groups. The overall trend shows that the forecast errors for ONCE and LEN firms are smaller and more stable, those for PER firms are less stable and those for REV firms are least stable and most volatile, with large ups and downs. This evidence once again suggests that the level and complexity of firm's MC requirements impact analysts forecasts and REV firms are the most difficult to forecast.

6.5 Institutional Investors

Because institutional investors hold large volume of stocks and are more sophisticated, their moves are likely to be more prudent and shrewd. In this section, I examine the responses of institutional investors to different MC patterns. Do institutional investors recognize the implications of MC requirements and take these into consideration when making their portfolio decisions? If they do, when do they recognize these implications? Can they distinguish between different MC patterns among firms?

From institutional holdings data (Thomson Financial 13-f Spectrum database), I calculate percent of institutional holdings (PIH) based on number of shares held by institutional investors and total number of shares outstanding. Since the data contains only the end-of-calendar-quarter holdings, PIH is calculated quarterly. Based on the

Figure 7. Analyst Quarterly Forecasted Errors For ONCE, LEN, PER and REV Firms from Quarter 0 to 20 after the First MC.

Forecast error is defined as the difference between forecasted mean and quarterly earnings scaled by the stock price of previous month and then multiplied by 100. ONCE includes firms that made mandatory contribution once. LEN, PER, REV are firm groups from factor and cluster analyses.

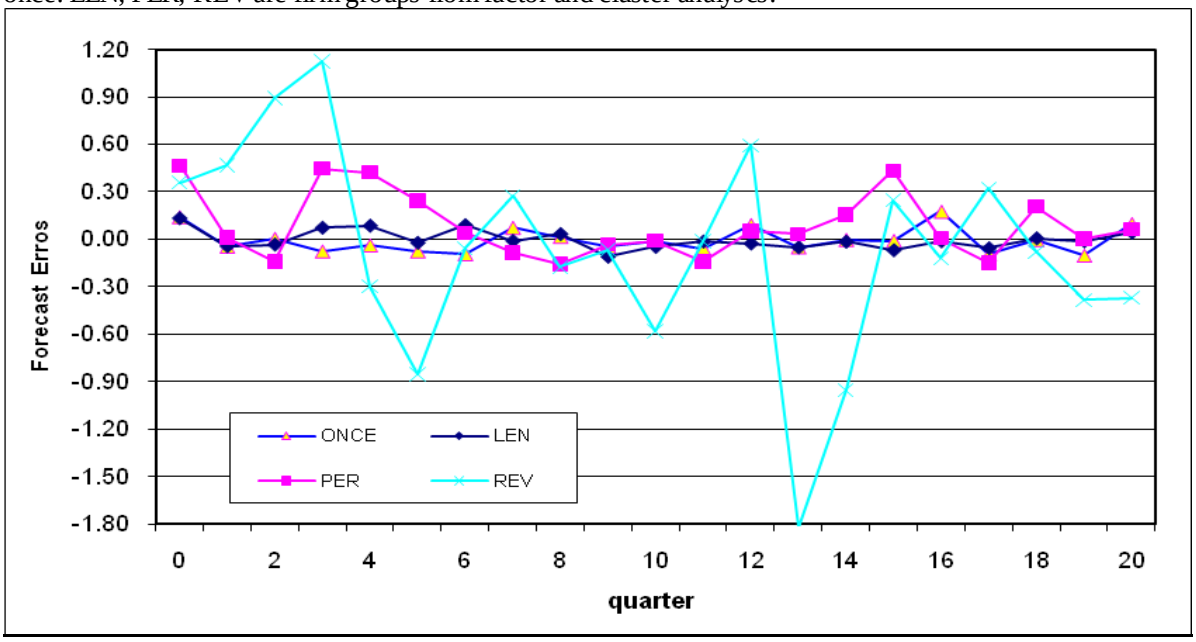
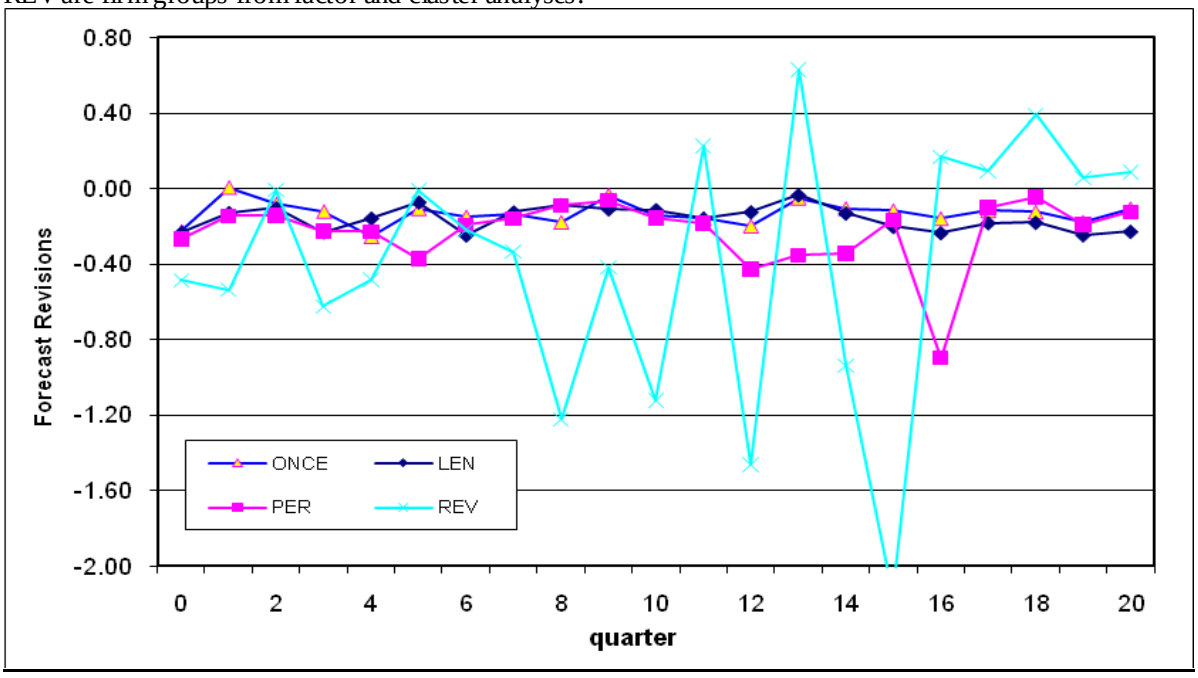


Figure 8. Analyst Quarterly Revisions for ONCE, LEN, PER and REV Firms from Quarter 0 to 20 after the First MC.

Forecast revision is defined as the difference between two consecutive forecasts of the same analyst in the quarter, averaged over all analysts. ONCE includes firms that made mandatory contribution once. LEN, PER, REV are firm groups from factor and cluster analyses.



classifications of Bushee (1998) and Abarbanell, Bushee, and Raedy (2003), I group investors into three investment classes: dedicated (DED), quasi-indexers (QIX) and transient (TRA) and four investment styles: large value (LGA), large growth (LGR), small value (SVA) and small growth (SGR) to examine whether the institutional holdings among MC firm groups are affected by investment classes and styles.

Panel A of Table 26 presents PIH and change in PIH data for NMC firms and four MC firm groups for the entire sample period. For the ONCE group and the three classified MC groups, I use data after the firm's first MC occurrence. Since firms in NMC group don't have a MC date, I used all the data to compare NMC and MC firms. The results of PIH in Panel A show that institutional investors, on average, don't hold fewer shares in MC firms than in NMC firms. Within MC groups, institutional holdings in the REV firm group drop 16.2% to 32.7%, and holdings in the PER firm group drop 1.4% to 48.5%. Holdings in the ONCE and LEN groups are slightly higher than holdings in MC firms in the aggregate.

Among the three investment classes, both quasi-indexer and transient investors invest the most shares in ONCE firms and the least in REV firms. Quasi-indexer investors have about the same holdings in ONCE, LEN and PER firms and substantially lower holdings in REV firms. Transient investor holdings decrease monotonically as we move from ONCE to REV firms. The holdings of dedicated investors show a different pattern. These investors have higher holdings in LEN and PER firms than in ONCE and REV firms. For the four investment styles, the large value and large growth investors invest the most in ONCE firms and the least in REV firms. However, like the quasi-index investors, their holdings among the ONCE, LEN and PER firm groups don't vary much. Small value investors show decreasing holdings from ONCE to REV firms although the holdings in ONCE and LEN firms are very close. Small growth investors who are willing to bear higher risks to seek short term gains don't hold less in REV firms. Large

Table 26. Percent of Institutional Holdings (PIH) and Changes in Percent of Institutional Holdings (CPIH) for NMC, ONCE, LEN, PER, ERV and MC Firms by the Investment Classe and Style.

NMC consists of firms that make no mandated contributions during the sample period. ONCE consists of the firms that make only one mandated contribution during the sample period. LEN, PER, REV are groups identified from factor and cluster analysis. The MC group represents all mandated contribution firms. The investement class and style are defined in Table 15. Data used in NMC and MC groups are from 1991 to 2005. For ONCE, LEN and PER and REV firm groups, data are after the first MC occurrence during the period 1991 to 2005.

Panel A. PIH.

		NMC	MC	ONCE	LEN	PER	REV
Class	DED	0.1017	0.1093	0.0921	0.1273	0.1285	0.1004
	QIX	0.2571	0.2592	0.2797	0.2713	0.2645	0.1625
	TRA	0.1049	0.1080	0.1302	0.1040	0.0923	0.0702
Style	LVA	0.1515	0.1427	0.1727	0.1557	0.1580	0.0847
	LGR	0.1228	0.1224	0.1332	0.1330	0.1241	0.0681
	SVG	0.0967	0.1021	0.0970	0.0954	0.0858	0.0734
	SGR	0.0874	0.1022	0.0991	0.1174	0.1174	0.1010
	Total	0.4885	0.4991	0.5019	0.5014	0.4853	0.3272

Panel B. CPIH.

Class	DED	0.0031	0.0038	0.0026	0.0041	0.0052	0.0045
	QIX	0.0070	0.0076	0.0086	0.0086	0.0076	0.0093
	TRA	0.0077	0.0085	0.0096	0.0091	0.0095	0.0065
Style	LVA	0.0035	0.0035	0.0041	0.0042	0.0039	0.0037
	LGR	0.0033	0.0040	0.0034	0.0034	0.0045	0.0024
	SVG	0.0050	0.0053	0.0058	0.0054	0.0046	0.0058
	SGR	0.0060	0.0073	0.0074	0.0088	0.0093	0.0078
	Total	0.0193	0.0222	0.0208	0.0218	0.0224	0.0197

investors and quasi-index investors show similar patterns, investing less in REV firms and about the same in ONCE, LEN and PER firms, indicating that these institutional investors can distinguish between REV firms and the rest of MC firms. Small value and transient investor holdings decrease monotonically from ONCE to REV firms, although differences in holdings among the four MC firm groups are small. Neither the small growth nor the dedicated investors seem to view REV firms differently from other MC firms, although their holdings in LEN and PER firms are slightly higher.

Panel B of Table 26 shows changes in PIH. Overall changes show that institutional investors engage in more trading activities in MC firms than in NMC firms. Transient investors, with the lowest holdings among the investor classes, trade most frequently, consistent with their short-term strategy. Small investors, with fewer holdings than large investors, trade more frequently than the large investors. Further, small growth investors trade more frequently than small value investors. Within the four group classifications, dedicated investors trade more in PER and REV firms than in ONCE and LEN firms. Changes in the holdings of other investors don't exhibit a clear pattern.

CHAPTER 7

ROBUSTNESS ANALYSES

7.1 Selection Bias

The data in Table 3 show a relatively high proportion of MC firms are in the Transportation, Metal and Machinery industries. This raises concerns that the grouping strategy used in this study might have resulted in selection biases, reflecting the special characteristics of some industries. For example, instances of MC for firms in the machinery industry during a particular period could result from cyclical effects affecting the industry during that period. There could be unobserved variables that are correlated both with MC and industry characteristics, affecting inferences drawn from analyses based on my grouping strategy.

To test the robustness of my findings I employ the Heckman two-stage model. The first stage model is a logit model utilizing all available data, including both MC and NMC firms. The second stage is a probit model focusing only on MC firms (a subset of the first stage estimation sample). The selection control variable constructed from the predicted values obtained in the first stage is included as a regressor in the second stage model (Heckman, 1997). The main focus of this analysis is not the selection bias per se, but whether the characteristics of MC groups documented in previous sections still hold after taking possible selection bias into consideration.

In the second stage, I first model the six MCX firm groups that make consecutive mandatory contributions for periods ranging from one year (MC1) to six or more years (MC6). Columns 2 and 3 in Table 27 report the results of the two stage estimations. Column 2 shows the results of the first stage logit analysis that models the likelihood of a

Table 27. Determinants of Mandatory Contribution (MC) by Controlling for Sample Selection Bias.

Heckman's two-stage model is applied. The first stage equation models the likelihood that a firm makes mandatory contribution (MC) as a function of pension plan characteristics. The second stage[1] equation uses the six consecutive MC firm groups and models the likelihood that a firm makes longer consecutive MC as a function of pension plan characteristics and the conditional expectation of unobservable factors determined based on the outputs of the first stage equation. The six firm groups are MC1 to MC6 with MC1 consisting of firms with one MC year, MC2, MC3, MC4, MC5 and MC6 consisting of firms with two, three, four, five and six (or more) consecutive MC years, respectively. The second stage[2] equation uses the ONCE, LEN, PER and REV MC group classifications and models the likelihood that a firm becomes a more severely impacted MC firm as a function of pension plan characteristics and the conditional expectation of unobservable factors determined based on the outputs of the first stage equation. ONCE includes firms that made only one mandated contribution during the sample period. LEN, PER and REV are groups identified from factor and cluster analyses.

	First stage logit model MC=1	Second Stage[1] probit model Prob(lower order)	Second Stage[2] probit model Prob(lower order)
Intercept	-4.2121***	-1.3562***	-0.8883***
Intercept2		0.2597***	1.1578***
Intercept3		0.6334***	2.9545***
Intercept4		0.0097***	
Intercept5		1.5202***	
GWAY	-0.0176***	-0.0071***	-0.0207***
DRC	6.0509***	0.7936***	0.5645***
CurAst	-1.4537***	-0.4693	-0.6309***
CurLia	1.3328***	0.5369*	0.5805***
NewLia	0.8832***	0.1617	0.0808
Selection Correction		0.2069***	0.1508***
Control variables			
Industry	Yes	yes	yes
Year	Yes	yes	yes

[1] Probit equation models the lower order of the six consecutive MC groups, with MC6 (order 1), MC5 (order 2), MC4 (order 3), MC3 (order 4), MC2 (order 5), MC1 (order 6).

[2] Probit equation models the lower order of the four MC groups, with REV (order 1), PER (order 2), LEV (order 3), ONCE (order 4).

*, **, *** represent significance at the 0.10, 0.05 and 0.01 level, respectively.

firm being an MC firm. As GWAY (Gateway percent) and CurAst (current fund asset) increase, the likelihood of a firm being an MC firm decreases. On the other hand, as DRC (deficit reduction contribution), CurLia (fund current liability) and NewLia (fund new liability amount) increase, the likelihood of a firm being an MC firm increases.

Column 3 presents the results of the probit model with "selection control" added as an extra regressor. Since lower order values represents higher number of consecutive MC years, the model estimates the probability of a firm making more consecutive years of mandatory contribution, given that it is an MC firm. The selection control variable is significant, indicating the selection control is necessary to reduce selection bias. The coefficients show that the likelihood of a firm making more consecutive years of mandatory contribution increases as GWAY decreases, and as DRC and CurLia increase. Neither CurAst nor NewLia are significant. Since I model the groups with the ordinal probit model, the intercepts are the cutoff points of the cumulated distribution function (CDF), and measure the likelihood of the group(s) being above specific cutoff points. For example, INTERCEPT measures the likelihood of an MC6 versus an MC1 to MC5 classification, when other variables are held constant; INTERCEPT2 measures the likelihood of a classification above the MC4 level, etc. All intercepts are significant, providing some evidence about the reliability of the estimated cutoff points.

Using a similar approach, I then model the likelihood of MC firms being classified as ONCE firms (with only one MC year) or one of the three groups identified by factor and cluster analyses (LEN, PER and REV). Column 4 in Table 27 reports the results of this second stage estimation. I define the order values 4, 3, 2 and 1 corresponding to ONCE, LEN, PER and REV firms. Then I model the probability of a firm falling to a lower level group after inclusion of the selection control variable. Except

for NewLia, all coefficients are significant in the expected direction, revealing a strong relation between the likelihood of a firm falling to a lower level group and GWAY, DRC, CurAst and CurLia. The likelihood increases as DRC and CurLia decrease and as GWAY and CurAst increase. The insignificance of NewLia is probably because it is a major component of DRC. The significance of selection control variable indicates the importance of its inclusion in the second stage estimation. All intercepts are significant, indicating that the cutoffs between the various classifications are significantly demarcated, after the inclusion of the section control variable.

Both models show that after controlling sample selection bias, the likelihood of a firm falling into one of the six MCX groups (from MC1 to MC6) or along the ONCE, LEN, PER, REV spectrum is associated with GATEWAY, DRC, CurAst and CurLia, supporting the belief that the constructed MC groups reflect differences in pension funding status reasonably well.

7.2 Industry Clusters

It could be argued that even if differences among the ONCE, LEN, PER and REV firm groups reflect differences in the pension funding status, the differences in adjusted returns among these groups may be due to clustered industry effects because models (1), (2) and (3) don't adjust for an industry effect. Since all three models include the market beta some of the industry effect is likely controlled for. Nevertheless, to test the robustness of my results, I perform regression analysis to examine the group effects on the risk-adjusted returns after controlling for the industry effect. I use the General Linear Model (GLM) because the Group and Industry regressors are discrete and their coefficient matrix does not have full rank.

Table 28 reports results of the risk-adjusted returns from the three regression models for the six MCX firm groups by controlling for any industry effect. Panel A shows the univariate analysis results. The industry variable is not significant for any risk-adjusted returns. The group effect is weak for the market adjusted returns, not significant for VWRET, and only marginally significant for the EWRET. But for the three-factor and four-factor adjusted returns, group effects are all significant with p-value less than 0.01. The industry effect is not significant in any model. The interaction between group and industry is not significant either. Panel B shows the p-values of the contrasts between the six groups. The three-factor and four-factor adjusted returns exhibit more differences than the market-adjusted returns. As the gap between the number of MC years increases, the differences between the two corresponding groups become more pronounced. The evidence indicates that the differences in risk-adjusted returns across MC groups are not affected by industry affiliation.

Table 29 reports results of the risk-adjusted returns from the three regression models for NMC, ONCE, LEN, PER and REV MC firm groups after controlling for any industry effect. Panel A shows a significant industry effect, possibly because NMC firms are included. However, all risk-adjusted returns are significant different among groups after controlling for the industry effect. Except for the market-adjusted model using VWRET, there is no interaction between group and industry, showing that return differences among the groups are not affected by industry.

Panel B shows the p-values of contrasts between the five MC firm groups. Differences among these five groups are more pronounced than among the six MCX

Table 28. Analyses of Value-Weighted and Equally-Weighted Returns (VWRET and EWRET) Adjusted for Risk Using Three Regression Models for Six Consecutive Mandatory Contribution (MC) Firm Groups after Controlling for the Industry Effect.

The six firm groups are MC1 to MC6 with MC1 consisting of firms with one MC year, MC2, MC3, MC4, MC5 and MC6 consisting of firms with two, three, four, five and six (or more) consecutive MC years, respectively. The dependent variables are Value-Weighted (VWRET) and Equally-Weighted (EWRET) returns adjusted for risk using three regression models. The independent variables are Group, Industry and the interaction of the two.

Panel A. Univariate Analyses by General Linear Model (GLM).

		VWRET				EWRET			
					Market Adjusted Returns				
Source	DF	SS	MS	F-statistic	P-value	SS	MS	F-statistic	P-value
group	5	0.116	0.023	1.61	0.154	0.145	0.029	2.02	0.073
industry	18	0.290	0.016	1.12	0.329	0.286	0.016	1.11	0.339
group*industry	76	0.985	0.013	0.90	0.724	0.998	0.013	0.91	0.692
					Three-Factor Adjusted Returns				
group	5	0.279	0.056	3.831	0.002	0.291	0.058	4.134	0.001
industry	18	0.301	0.017	1.149	0.295	0.261	0.014	1.029	0.422
group*industry	76	0.942	0.012	0.852	0.818	0.887	0.012	0.829	0.856
					Four-Factor Adjusted Returns				
group	5	0.440	0.088	6.056	0.000	0.290	0.058	4.153	0.001
industry	18	0.300	0.017	1.149	0.296	0.256	0.014	1.018	0.435
group*industry	76	0.940	0.012	0.852	0.818	0.866	0.011	0.815	0.878

Table 28. (Continued)

Panel B. P-values of the Contrast tests between the Six Consecutive MC Firm Groups by GLM. The cell that intersects the row group and column group represents the contrast test between the two groups.

	VWRET					EWRET				
					Market Adjusted Returns					
	MC2	MC3	MC4	MC5	MC6	MC2	MC3	MC4	MC5	MC6
MC1	0.506	0.708	0.074	0.053	0.316	0.909	0.970	0.463	0.5136	0.0176
MC2		0.889	0.244	0.146	0.158		0.908	0.456	0.4949	0.0438
MC3			0.252	0.153	0.282			0.576	0.5899	0.0669
MC4				0.656	0.020				0.9516	0.0152
MC5					0.016					0.0373
					Three-Factor Adjusted Returns					
MC1	0.236	0.003	0.669	0.496	0.008	0.983	0.311	0.476	0.222	0.001
MC2		0.076	0.227	0.187	0.159		0.374	0.508	0.243	0.003
MC3			0.010	0.013	0.640			0.179	0.087	0.080
MC4				0.771	0.018				0.575	0.001
MC5					0.023					0.001
					Four-Factor Adjusted Returns					
MC1	0.003	0.000	0.465	0.958	0.001	0.661	0.265	0.246	0.090	0.002
MC2		0.200	0.174	0.105	0.491		0.495	0.175	0.064	0.015
MC3			0.022	0.016	0.537			0.075	0.029	0.152
MC4				0.652	0.058				0.507	0.001
MC5					0.039					0.000

Table 29. Analyses of Value-Weighted and Equally-Weighted returns (VWRET and EWRET) Adjusted for Risk Using Three Regression Models for NMC, ONCE, LEN, PER, REV Firm Groups after Controlling for the Industry Effect.

NMC represents firms with no mandated contribution. ONCE includes firms that made only one mandated contribution during the sample period. LEN, PER and REV are groups identified from factor and cluster analyses. Dependent variables are Value-Weighted and Equally-Weighted returns (EWRET) adjusted for risk using three regression models. The independent variables are Group, Industry and the interaction of the two.

Panel A. Panel A. Univariate Analyses by General Linear Model (GLM).

		VWRET				EWRET			
					Market Adjusted Returns				
Source	DF	SS	MS	F-statistic	P-value	SS	MS	F-statistic	P-value
group	4	0.261	0.065	7.68	0.000	0.318	0.080	6.09	0.000
industry	18	1.797	0.100	11.77	0.000	1.656	0.092	7.04	0.000
group*industry	69	1.438	0.021	2.46	0.000	0.970	0.014	1.08	0.310
					Three Factor Adjusted Returns				
group	4	0.396	0.099	7.51	0.000	0.613	0.153	12.01	0.000
industry	18	1.660	0.092	7.01	0.000	1.558	0.087	6.79	0.000
group*industry	69	0.962	0.014	1.06	0.344	0.924	0.013	1.05	0.363
					Four Factor Adjusted Returns				
group	4	0.653	0.163	12.44	0.000	0.391	0.098	7.69	0.000
industry	18	1.648	0.092	6.97	0.000	1.535	0.085	6.72	0.000
group*industry	69	0.949	0.014	1.05	0.371	0.909	0.013	1.04	0.394

Table 29. (Continued)

Panel B. P-values of the Contrast Tests between Various MC Firm Groups by GLM. The cell that intersects the row group and column group represents the contrast test between the two groups.

	VWRET				EWRET			
	Market Adjusted Returns							
	ONCE	LEN	PER	REV	ONCE	LEN	PER	REV
NMC	0.366	0.772	0.001	0.060	0.976	0.082	0.000	0.091
ONCE		0.536	0.011	0.180		0.180	0.000	0.105
LEN			0.002	0.085			0.003	0.296
PER				0.494				0.509
	Three Factor Adjusted Returns							
NMC	0.018	0.225	0.000	0.003	0.806	0.003	0.000	0.032
ONCE		0.002	0.000	0.000		0.041	0.000	0.052
LEN			0.000	0.012			0.000	0.294
PER				0.762				0.064
	Four Factor Adjusted Returns							
NMC	0.000	0.029	0.000	0.006	0.329	0.244	0.000	0.323
ONCE		0.000	0.000	0.000		0.079	0.000	0.180
LEN			0.016	0.052			0.000	0.576
PER				0.657				0.040

groups (Panel B, Table 28). Differences in returns between two groups tend to increase with their distance from each other along the funding shortfall spectrum. The severity of the MC effect on the risk-adjusted returns increases from ONCE to LEN, PER and REV firms. Once again, the three-factor and four-factor adjusted returns exhibit more differences across groups than the market-adjusted returns. The evidence suggests that NMC and ONCE firms are different from PER and REV firms after controlling for the industry effect.

Overall, the above analyses suggest that the results documented in chapters 5 and 6 hold after controlling for industry effects, alleviating concerns that industry clustering might limit the ability to draw reliable inferences from prior results.

7.3 Changes in MC Requirement Rule

ERISA changed the MC rule in 1995, lowering the underfunding threshold from 100% to 80%-90%. The different thresholds in the two periods might affect stock return results. To address this concern, I perform two tests. In the first test, I define a binary variable YG (year group) which takes value 1 if an observation is before year 1995 and value 0 otherwise and then repeat the analyses as shown in section 7.2 with the YG variable added to the GLM model. The results are essentially the same as shown in Table 28 and 29 with contrast tests are almost identical[8], suggesting that the change of MC requirement doesn't drive the empirical results.

In the second test, I divide the sample into two periods, the first spanning 1991 to 1994, and the second spanning 1995-2005, and then compute the risk-adjusted returns for the NMC, ONE, LEN, PER, REV firm groups to examine whether the observed

[8] The results are not tabulated.

differences among the five firm groups documented in Chapter 4 still hold. The drawback for this test is that the samples become smaller and hence the predictive power is reduced, especially for the 1991 to 1994 period, and for REV firm group which has the least number of firms.[9] Nonetheless, this analysis could be useful as a validity test, check whether the results derived from the whole period are consistent in the two period sub-samples[10].

Table 30 shows the results of these analyses.[11] Panel A reports the risk-adjusted monthly returns for the five firm groups from the three models for the first period (1991 to 1994). REV firms earn significantly positive market-adjusted returns, but returns are not significantly different from zero for the three-factor and four-factor models. For both value and equally-weighted returns, NMC and ONCE firms earn significantly higher market-adjusted returns than LEN and PER firms, and earn significantly higher three-factor and four-factor adjusted returns than LEN, PER and REV firms. Except the four-factor adjusted returns, no differences are observed between NMC and ONCE firms. Among the three groups classified by factor and cluster analyses, LEN and PER firms earn higher three-factor and four-factor value adjusted returns than REV firms, and LEN firms earn higher three-factor and four-factor equally-weighted returns than PER firms. Despite the short period and relatively small sample size (26% of the whole sample), the first period from 1991 to 1994 still shows differences between NMC & ONCE firms, on the one hand, and LEN, PER and REV firms, on the on the other, as well as differences among LEN, PER and REV firms, corroborating the previous findings of this study.

[9] In the period 1991 to 1994, the REV group consists of 27 firms while ONCE, LEN and PER groups consist of 168, 309 and 87 firms.
[10] The usual method for testing method validity is to split a given sample into two random samples and run the same analysis on both samples. Since my splitting is not random, the validation test may be biased.
[11] The two periods test can't be applied to the six consecutive mandatory contribution (MCX) firm groups because MC5 and MC6 are not defined in the 1991 to 1994 period.

Table 30. Value-Weighted and Equally-Weighted Monthly Returns (VWRET and EWRET) Adjusted by Market, Three-Factors and Four-Factors for NMC, ONCE, LEN, PER and REV Firm Groups for Periods 1991 to 1994 and 1995 to 2005.

NMC represents firms with no mandated contribution. ONCE includes firms that made only one mandated contribution during the s ample period. LEN, PER and REV are groups identified from factor and cluster analyses. T-statistics for the various risk-adjusted mean returns are presented in parentheses.

Panel A. 1991 to 1994 Period.

	VWRET					EWRET				
	NMC	ONCE	LEN	PER	REV	NMC	ONCE	LEN	PER	REV
					Market Adjusted Returns					
Mean	0.0057	0.0072	0.0048^{aB}	0.0038^{aB}	0.0053	0.0065	0.0065	0.0048^{Ab}	0.0038^{Ab}	0.0050
	(13.000)	(7.555)	(6.542)	(2.526)	(2.655)	(14.826)	(6.845)	(6.646)	(2.532)	(2.657)
Median	0.0031	0.0039	0.0025	0.0015	0.0013	0.0036	0.0033	0.0026	0.0015	0.0013
					Three-Factor Adjusted Returns					
Mean	0.0065	0.0084	0.0044^{AB}	0.0050^{B}	0.0017^{ABCD}	0.0020	0.0023	0.0001^{AB}	-0.0035^{ABC}	-0.0018^{AB}
	(14.682)	(8.796)	(5.979)	(3.316)	(0.540)	(4.719)	(2.423)	(0.193)	(-2.368)	(-1.062)
Median	0.0041	0.0049	0.0020	0.0025	-0.0069	-0.0005	0.0000	-0.0021	-0.0046	-0.0037
					Four-Factor Adjusted Returns					
Mean	0.0067	0.0103^{A}	0.0048^{AB}	0.0047^{aB}	0.0009^{ABCD}	0.0027	0.0038	0.0013^{AB}	-0.0018^{ABc}	-0.0008^{aB}
	(15.190)	(10.747)	(6.645)	(3.078)	(0.281)	(6.301)	(3.968)	(1.846)	(-1.218)	(-0.200)
Median	0.0042	0.0072	0.0025	0.0015	-0.0069	0.0003	0.0012	-0.0007	-0.0030	-0.0033

$^{A(a)}$ indicates the mean is significantly different from NMC firms at 0.01 (0.05) level.
$^{B(b)}$ indicate the mean is significantly different from ONCE firms at 0.01 (0.05) level.
$^{C(c)}$ Indicate the mean is significantly different from LEN firms at 0.01 (0.05) level.
$^{D(d)}$ indelicate the mean is significantly different from PER firms at 0.01 (0.05) level.

Table 30. (Continued)

Panel B. 1995 to 2005 Period.

	VWRET					EWRET				
	NMC	ONCE	LEN	PER	REV	NMC	ONCE	LEN	PER	REV
					Market Adjusted Returns					
Mean	0.0049	0.0028^{A}	0.0034^{A}	0.0006^{ABC}	-0.0043^{ABCD}	0.0061	0.0045^{a}	0.0031^{Ab}	-0.0008^{ABC}	-0.0012^{ABC}
	(16.270)	(4.203)	(6.869)	(0.541)	-(1.995)	(20.284)	(6.874)	(6.245)	(-0.712)	(-0.564)
Median	0.0025	0.0006	0.0020	-0.0001	-0.0076	0.0038	0.0022	0.0017	-0.0016	-0.0047
					Three-Factor Adjusted Returns					
Mean	0.0040	0.0041	0.0011^{AB}	-0.0017^{ABC}	-0.0075^{ABCD}	0.0010	-0.0003	-0.0022^{AB}	-0.0073^{ABC}	-0.0055^{ABC}
	(13.065)	(6.262)	(2.197)	(-1.592)	(-3.527)	(3.459)	(-0.443)	(-4.417)	(-7.065)	(-2.614)
Median	0.0013	0.0019	-0.0004	-0.0023	-0.0108	-0.0017	-0.0025	-0.0038	-0.0095	-0.0094
					Four-Factor Adjusted Returns					
Mean	0.0036	0.0056^{A}	0.0005^{AB}	-0.0027^{ABC}	-0.0033^{ABC}	0.0029	0.0022	0.0006^{Ab}	-0.0045^{ABC}	-0.0044^{ABC}
	(11.905)	(8.460)	(1.088)	(-2.575)	(-1.530)	(9.576)	(3.346)	(1.276)	(-4.247)	(-2.026)
Median	0.0010	0.0033	-0.0008	-0.0033	-0.0050	0.0002	-0.0003	-0.0007	-0.0060	-0.0065

$^{A(a)}$ indicates the mean is significantly different from NMC firms at 0.01 (0.05) level.
$^{B(b)}$ indicate the mean is significantly different from ONCE firms at 0.01 (0.05) level.
$^{C(c)}$ Indicate the mean is significantly different from LEN firms at 0.01 (0.05) level.
$^{D(d)}$ indelicate the mean is significantly different from PER firms at 0.01 (0.05) level.

Panel B reports the risk-adjusted monthly returns of the five firm groups from the three models for the second period (1995 to 2005). The results show that NMC and ONCE firms earn higher risk adjusted returns than LEN, PER and REV firms, and LEN firms earn higher risk adjusted returns than PER and REV firms. Between NMC and ONCE firms, only one of four differences for three-factor and four-factor adjusted returns is significant, showing that NMC and ONCE firms generally do not earn different three-factor and four-factor adjusted returns. In comparison with the results in Panel A, the results in Panel B show clearer differences between LEN, PER and REV firms. Specifically, LEN firms earn higher returns than PER and REV firms for all risk-adjusted models and PER firms earn higher value-weighted market and three-factor adjusted returns than REV firms.

Overall, the split sample test shows that the results are consistent in the two periods and the change in the MC requirement rule has little effects on the findings of this study.

CHAPTER 8

CONCLUSION

The impact of pension information on market valuation is an important issue that has not to date been explored in depth. This research seeks to investigate how the market, analysts and institutional investors respond to mandatory pension contributions to better understand the utilization of pension information.

Using plan-level pension 5500 schedule B data along with Compustat, CRSP, I/B/E/S, and institutional holdings data, I find that firms that make mandatory contributions frequently have lower market returns than those that make mandated contributions for shorter periods. Using factor and cluster analyses based on mandatory contribution characteristics, I classify firms with two or more years of mandated contributions into three groups: Lenient (LEN), Perpetual (PER) and Revert (REV) firms that differ in terms of their MC patterns and the severity of their funding shortfall.

All risk-adjusted returns show PER and REV firms earn significantly lower returns from the first quarter to five years after the first MC occurrence. I also find that market is most negatively surprised by the MC implications for PER and REV firms. Analysts tend to overestimate MC firms, and subsequently make negative revisions when additional information becomes available. The magnitudes of forecast errors and forecast revisions increase for firms with a more protracted MC string, and more complex MC patterns.

Additionally, I find that institutional investors seem to incorporate MC information into their holdings two years after the first MC occurrence. The holdings vary among the MC firm groups depending on investment class and style. Quasi-indexers, large value and large growth investors can differentiate between REV firms and other MC group firms and hold substantial fewer shares in REV firms. Transient

investors also reduce holdings in REV firms two years after the first MC occurrence.

This paper makes several contributions to existing literature. I demonstrate that the impact of the MC requirement on market returns depends on the nature of the MC patterns exhibited by different firms. Firms with one year of MC payments are not viewed any differently from firms with no MC requirement during the sample period. I classify MC firms into groups based on factor and cluster analyses to capture different MC characteristics and show that market responses vary systematically across the identified groups of MC firms. I also provide evidence that analysts take MC into consideration but are unable to fully understand the implications of different MC patterns, resulting in larger forecast errors for some MC group firms than for others. Finally, I show that institutional investors take MC into consideration two years after the firm's first MC occurrence. Institutional investors react to the four MC firm groups differently depending on the investing class and style.

REFERENCES

Abarbanell, J.S., B. Bushee and J.S. Ready. 2003. Institutional Investor Preferences and Price Pressure: The Case of Corporate Spin-offs. *Journal of Business* 76-2, 223-261.

Altman, Edward I. 1968. Financial Ratios, Discriminant Analysis, and the Prediction of Corporate Bankruptcy. *Journal of Finance* 23, 589-609.

Bauman, W. Scott and Richard J. Dowen. 1994. Security Analyst Forecasts and the Earnings Yield Anomaly. *Journal of Business Finance & Accounting*, 21(2), 283-291.

Bodie, Zvi. 1990. The ABO, the PBO, and Pension Investment Policy. *Financial Analysis Journal* 46, 27-34.

Buesing, M., and M. Soto. 2006. The State of Private Pensions: Current 5500 Data. An Issue in Brief Center for Retirement Research at Boston College, February 2006, Number 42.

Bushee, B. 1998. The Influence of Institutional Investors on Myopic R&D Investment Behavior. *The Accounting Review* 73, 305-333.

Callen, J., J. Livnat, and S. Ryan. 1996. Capital Expenditures: Value-Relevance and Fourth-Quarter Effects. *The Journal of Finance Statement Analysis* 1 (Spring), 13-24.

Chan, K., L. Chan, N. Jegadeesh, and J. Lakonishok. 2006. Earnings Quality and Stock Returns. *Journal of Business*, 79, 1041-1082.

Chan-Lau, Jorge A. 2004. Pension Funds and Emerging Markets, IMF working paper, WP/04/81.

Chen, X., and T. Yao, T. Yu and T. Zhang. 2008. Pension Underfunding, Analyst Experience, and Analyst Underreaction. Working paper.

Comprix, J., and K. A. Muller III. 2006, Asymmetric Treatment of Reported Pension Expense and Income Amounts in CEO Cash Compensation Calculations, *Journal of Accounting and Economics* 42, 385-416.

Coronado, Julia and Steven A. Sharpe. 2003. Did Pension Plan Accounting Contribute to a Stock Market Bubble?" BPEA (1): 323-359.

Coronado, Julia, O. S. Mitchell, S. A. Sharpe and S. B. Nesbitt. 2008. Footnotes Aren't Enough: The Impact of Pension Accounting on Stock Values. *Journal of Pension Economics and Finance*, 70:257-276.

Davis-Friday, P.Y., L.B. Folani, C. Liu and H.F. Mittelstaedt. 1999. The Value Relevance of Financial Statement Recognition vs. Disclosure: Evidence from SFAS No. 106. *The Accounting Review* 74 (4): 403-423.

Fama, E., and K. French. 1993. Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics* 33, 3-56.

Fama, E., and K. French. 1997. Industry Cost of Equity, *Journal of Financial Economics* 43, 153-193.

Fortune, Peter. 2005. Pension Accounting and Corporate Earnings: the World According to GAAP, Public Policy Discussion Paper 06-2, Federal Reserve Bank of Boston.

Franzoni, F., and J. M. Marin. 2006. Pension Plan Funding and Stock Market Efficiency, *Journal of Finance* VOL. LXI, NO.2, 921-956.

Franzoni, Francesco. 2009. Underinvestment vs. Overinvestment: Evidence from Price Reactions to Pension Contributions, *Journal of Financial Economics*, Vol. 92, Issue 3, 491-518.

Gallo, J. G. and L. J. Lockwood. 1995. Determinants of Pension Funding and Asset Allocation Decisions, *Journal of Financial Services Research*, Vol. 2, 143-158.

GAO. 2004. Airline Plans' Underfunding Illustrates Broader Problems with the Defined Benefit Pension System. GAO-05-108T, October 7, 2004.

Gleason, Cristi A. and Charles. M. C. Lee. 2003. Analyst Forecast Revisions and Stock Market Price Discovery. *The Accounting Review*, Vol. 78, No. 1. 193-225.

Hribar, S.P, N.T. Jenkins, and W.B. Johnson. 2006. Stock Repurchase as An Earnings Management Device. *Journal of Accounting and* Economics 41, 3-27.

Kim, S. 2001. The Near-term Financial Performance of Capital Expenditure: A Managerial Perspective. *Managerial Finance*, Vol. 27 No. 8, 48-62.

Kwan, Simon. 2003. Pension Accounting and Reported Earnings, FRBSF Economic Letter, 2003-19. July 3, 2003.

La Porta, R. 1996. Expectations and the Cross-Section of Stock Returns. *Journal of Finance* 51, 1715-1742.

Lev, B., and S. Thiagaranjan. 1993. Fundamental Information Analysis, *Journal of Accounting Research* 31, 190-215.

Ling, L., Edwards J. Riedl and Grmgopal Venkataraman. 2008. The Determinants of Analyst-Firm Parings. *Journal of Accounting and Public Policy*, 27, 277-294.

Liu, Weixi, and Ian Tonks. 2009. Pension Fund Deficits and Stock Market Efficiency: Evidence from the United Kingdom, Business School, University of Exeter, Paper NO. 09/01.

McCourt, Stephen P. 2006. Defined Benefit and Contribution Plans: A History, Market Overview and Comparative Analysis. *Benefits & Compensation Digest*, Vol. 43, No. 2, February 2006.

Mitchell, Olivia S. 2002. New Trends in Pension Benefit and Retirement Provisions. NBER Working Paper NO. W7381.

Ohlson, James. 1980. Financial Ratios and the Probabilistic Predication of Bankruptcy, *Journal of Accounting Research* 18, 109-131.

Papanastasopoulos, Georgios, Dimitrios Thomakos and Tao Wang, 2007. Information in Balance Sheets about Future Stock Returns: Evidence From Operating Assets , Working Paper.

Picconi, Marck. 2004. The Perils of Pensions: Dose Pension Accounting Lead Investor and Analysts Astray? Ph.D. Dissertation, Cornell University.

Plumlee, M. A. 2003. The Effect of Information Complexity on Analysts' Use of that Information. *The Accounting Review* 78 (1):275-96.

Rauh, J.D. 2006, Investment and Financing Constraints: Evidence from the Funding of Corporate Pension Plans. *Journal of Finance*, VOL. LXI, NO. 1, 33-58.

Salva, Lawrence J. and David L. Beik. 2006. CCR and CBF Comment Letter, File Reference No. 1025-300, *Financial Executive International*.

Sharpe, W.F. 1976. Corporate Pension and Funding Policy. *Journal of Financial Economics*, Vol. 3, 183-193.

Sohn, William J. 2006. Letter to Financial Accounting Standard Board, Re: File Reference No. 1025-300. *American Academy of Actuaries*. May 31, 2006.

Zhang, Yinglei. 2006. Net Operating Assets as a Predictor of Industry Stock Returns, Working Paper. The Ohio State University.